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ABSTRACT

Presented is a manual for environmental education program leaders in public schools and other agencies who have little background in needs assessment and evaluation. Written as an instructional package for persons about to design and implement studies, the publication may also be useful for college students and instructors. The manual consists of: (1) a unit on needs assessment, (2) a unit on evaluation, and (3) an appendix containing pointers on technical procedures. Among the topics considered under needs assessment are planning considerations, basic steps and activities, and needs assessment models. The evaluation section discusses types of evaluation, how to review a design, and steps in developing and implementing an evaluation study. (Author/WB)

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ENVIRONMENTAL EDUCATION

NEEDS ASSESSMENT AND EVALUATION MANUAL

volume 1

prepared by
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for the
PLANNING AND EVALUATION UNIT
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PREFACE

PURPOSE OF THE MANUAL

As more and more demands are made on scarce public resources, all human services, including educational programs, are asked to justify their existence. The demands for public accountability make needs assessment and program evaluation extremely important.

It is difficult to get and keep good programs. Few environmental education programs are approved without a well documented need or continued without adequate evaluation. Although federal and state legislatures have provided funding, we must demonstrate that the programs make a difference. As the competition for available funds increases, the enthusiasm for supporting environmental education programs will disappear unless we demonstrate their value. Before positive evidence can be gathered at the national or state level, each local program must collect evidence of impact.

Unfortunately, few environmental educators are prepared to demonstrate need or to evaluate their programs. They do not have sufficient guidelines for conducting needs assessments and evaluations. We hope this manual will help fill the gap and serve as a practical tool for environmental educators.

WHO MIGHT USE THIS MANUAL

The manual was designed for environmental education program leaders in public schools and other social service agencies who have little, if any, training in needs assessment and evaluation. It may also be useful for persons interested in directing environmental education efforts at the state level as well as students and instructors of environmental education at the institutions of higher education. It was written as an instructional package for persons about to design and implement studies for the first time.

OVERVIEW OF THE MANUAL

The manual consists of two major units, an appendix, and sample pages of selected instruments. Unit One is concerned with **Needs Assessment** and Unit Two with **Evaluation.** The appendix contain special pointers on the technical procedures used in needs assessment and evaluation. The sample pages from selected instruments are intended to provide a good overview of the type of instruments that have been developed to collect data for Environmental Education. A complete reference is given for each instrument.

GOOD LUCK WITH YOUR ENVIRONMENTAL EDUCATION PROGRAM

Chapter 1 — INTRODUCTION TO NEEDS ASSESSMENT

So you want to start an environmental education program?

What makes you think it's a good idea?
How do you know the program is needed?

Can you convince all of the people who must approve your plan?

Such questions often frustrate program leaders who "just know" that an environmental education program will be the best thing since apple pie and flavored milk shakes. But in this day and age of public accountability, it isn't enough to "just know." You have to convince others that a **need exists** and **the planned program will help meet the need.**

OTHERS!!! WHAT OTHERS?

If you work for a school district, a lot of people must be convinced:
- Teachers
- Principals
- Curriculum Directors
- Superintendents
- State Department Personnel
- Private, State and/or Federal Funding Agencies

If you work with other human service agencies, you must convince:
- Agency Administrators
- City, County and/or State Leaders
- Private, State and/or Federal Funding Agencies

These individuals are contacted by dozens of groups who believe there are needs for a special program. Since public agencies have only a fraction of the resources required to meet all of the identified needs, these "others" become skeptical.

How do you convince others that your program will be as good as apple pie and flavored milk shakes? You start with a needs assessment.

WHAT IS A NEEDS ASSESSMENT?

A needs assessment is a set of activities that help document and describe deficiencies, i.e., undesirable differences between what people know or do and what is judged to be acceptable knowledge or behavior.

Most of us look for similar information when reading the report of a needs assessment. We want to know **whose needs** are examined, **who** determined the need and **how** the needs were identified. It is not adequate to merely summarize what experts have said about the importance of environmental education. The report of a needs assessment must contain a description of the data collected and analyzed in order to determine whether or not deficiencies exist.

When reviewing the report of a needs assessment, a checklist like the one on the next page is often used. Some reports are like owls: the **WHO, WHO** and **HOW** message is clear and precise.

WHOse needs were examined
WHO determined the needs
HOW the deficiencies were identified

Unfortunately, many discussions of needs sound more like turkeys — gobble, gobble, gobbledegook.

The three statements of need following the checklist are fictitious examples designed to represent typical reports. Use the checklist to review these, and see if you agree with our judgment of whether they sound like owls or turkeys.

CHECKLIST for Reviewing a Needs Assessment Report

WHOse NEEDS WERE EXAMINED?

Does the statement describe:

1. The group that will participate in the program? YES ____ NO ____
2. How many people will participate in the program? YES ____ NO ____
3. Exactly where the learners are located? YES ____ NO ____

WHO DETERMINED THE NEED?

Does the statement indicate who helped to identify needs?

4. The learners? YES ____ NO ____
5. The teachers? YES ____ NO ____
6. The parents? YES ____ NO ____
7. Community representatives? YES ____ NO ____
8. School or other agency? YES ____ NO ____
9. Selected outside experts? YES ____ NO ____

HOW THE NEEDS WERE IDENTIFIED

Does the statement describe the results from:

10. Tests? YES ____ NO ____
11. Questionnaires? YES ____ NO ____
12. An examination of environmental violations? YES ____ NO ____
13. Public forums? YES ____ NO ____
14. An examination of records of local participation in activities related to environmental concerns? YES ____ NO ____
15. Strategies used to assign priorities to needs? YES ____ NO ____
16. Other data? YES ____ NO ____

STATEMENT OF NEED - EXAMPLE ONE

The issue of developing energy resources is of great concern to everyone. Perhaps no single factor has such a profound effect on our quality of life in terms of both our economic well-being and the quality of our surrounding environment. Emerging plans for the development of new coal fields; shale oil production; and solar, nuclear, and wind energy sources are projected to have a major impact on the western states, especially the mountain states. Recent statements on the development of energy resources from within our nation, the reduction of imported fossil fuels, and the actions of private industry help to intensify the concern of westerners. Environmentalists have warned us of the negative results of careless actions taken in response to the energy crisis. They warn us of the danger of efforts to respond only to current demands.

How will we resolve the apparent conflict between the demand for energy and the desire to maintain the quality of our environment? Judicious action cannot result unless the public is accurately informed of all aspects of the debate. Although the energy crisis is well publicized, few people

understand the potential environmental effect that can result from uncontrolled, careless disruption of our environment. Willis W. Harman and his associates have provided two discussions that point out the complexity of concern about the environment and societal changes which are occurring. Among other points, these authors demonstrate that there are no clear answers; the issues must be squarely faced by an informed public. Unfortunately, a high percentage of our population appears to be uninformed about all aspects of the issue.

Schools can help respond to this need by providing well designed environmental programs for all students, especially secondary students who are rapidly approaching voting age. Among the students' educational needs are:

Ways of thinking - the ability to develop mental models of the world that organize present experience into patterns with a longer perspective.

Problem-solving skills - the ability to recognize and define a problem, identify choices, analyze data and choose from among alternatives.

Consideration of others - the ability to form a sense of "involvement" and "caring" on a personal level, development of responsible attitudes and the ability to deal with positive and negative feelings.

Harold Shane and James Coleman are just two of many scholars who have devoted much thought to the appropriate role of the schools in societal change. Their analyses indicate that the schools have traditionally played an important role in helping society deal with major issues. Over the past decades, the rate of societal change has expanded the expectations that are placed on schools. If our society is to survive, the schools must meet the challenge by providing our youth with the knowledge required to adequately deal with issues such as the energy/environment problem.

If you used the checklist on page 3, you probably checked NO for most of the items. Example One is a real turkey!

STATEMENT OF NEED - EXAMPLE TWO

Central High School is the only school serving Kit City, Colorado, and the surrounding farm area. The 1977-78 enrollment consisted of 321 seniors, 364 juniors and 386 sophomores. Of these 1071 students, 570 were female, 501 male; 336 represented ethnic minorities and 735 non-minorities.

Kit City is located 31 miles north of Denver, Colorado, and three miles west of Interstate Highway 25. Between 1968 and 1978, 20 new working oil wells have been placed on farm lands within the school district boundaries. Kit City is also located within 20 miles of a nuclear power plant. The mountain area immediately west of the city is known for its trout fishing, large game animals and national wilderness areas.

The mix of outdoor-oriented long time residents and new residents has attracted considerable attention. Between June 1, 1977, and May 30, 1978, advocate groups have sponsored four public meetings. During that same year the local newspaper published 56 letters to the editor commenting on environment and/or energy issues. One consistent theme in these discussions was the lack of public awareness, the fuzzy thinking and low-level future orientations demonstrated by the community at large. Participants in the public meetings and approximately 20% of the letters have placed part of the blame for limited public awareness on the absence of a high school environmental education program.

In response to these criticisms, the local school board, superintendent and curriculum director asked the high school to design an environmental education program that could be incorporated into existing regular courses at all three grade levels. The social studies department has agreed to use selected environmental education units within the required social studies courses. The content of the unit is described in a subsequent section of this document. In order to implement the plan there is a need for a three-day teacher inservice program on environmental education and a need to purchase audio-visual aids and other special materials. A list of these materials is included in a subsequent section of this document.

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Example Two is part owl and part turkey. It tells us **whose** needs were assessed but fails to tell us who determined the needs and how the needs were documented. We can't be sure the high school students' knowledge and skills are deficient.

STATEMENT OF NEED - EXAMPLE THREE

Central High School is the only school serving Kit City, Colorado, and the surrounding farm area. Last year's enrollment consisted of 321 seniors, 364 juniors and 386 sophomores. Of these 1071 students, 570 were female, 501 male; 336 represented ethnic minorities and 735 non-minorities.

Kit City is located 31 miles north of Denver, Colorado, and three miles west of Interstate Highway 25. Between 1968 and 1978, 20 new working oil wells have been placed on farm lands within the school district boundaries. Kit City is also located within 20 miles of a nuclear power plant. The mountain area immediately west of the city is known for its trout fishing, large game animals and national wilderness areas.

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To examine the validity of these charges a locally constructed test and attitude inventory were given to a 25% sample of high school students on May 6, 1978. (Twenty-five percent of the students at each grade level were randomly selected.)

The test consisted of items selected from five different environmental education tests recommended by the state department of education. The attitude inventory was a form adapted from the materials published by the Minnesota Environmental Council. Copies of the test and attitude inventory are included in Appendix A along with detailed frequency distributions obtained from the sample of high school students. The results indicated that boys and girls had about equal knowledge and there were no differences by ethnic group. There were some sex differences on the attitude scale, but no ethnic differences. The results were consistent across all three grade levels.

Taking the group as a whole, the mean number of questions correctly answered by the students were: 5 of the 25 questions on energy, 11 of the 20 questions on earth resources, 3 of the 18 questions on resource reclamation, 15 of the 20 questions on population processes and 12 of 23 questions on quality of life. Responses to the attitude inventory indicated that 82% of the students had considerable concern for present environmental problems but only 32% were future oriented and 76% indicated they believed they could have no influence on public decisions.

After the results of the student test and attitude scales were tabulated, 200 parents were randomly selected and invited by mail to attend a special discussion session. The purpose of this session was to review the results of the test and attitude survey. Forty-two parents attended the session. During the session, six groups of seven parents were formed to review the results and identify areas of greatest discrepancy between the results and what they considered to be acceptable mean scores. A similar session was held with nine selected representatives of local community groups.

In both cases discrepancies were classified as very important, somewhat important, or not important. Twelve items were classified as very important, fifteen as somewhat important and the remaining discrepancies judged to be unimportant.

The twenty-seven important and somewhat important items were placed on a teacher survey instrument and on a student survey instrument. Teachers were asked to (A) identify how, if at all, they covered the topic in any of their current classes, (B) describe the extent of their preparation and ability to adequately cover the topic in one of their existing classes, (C) indicate where they believed the topic could best fit into the existing high school curriculum, and (D) rate the importance of the topic. Students were asked to use a five-point scale to rate the importance of each of the twenty-seven topic areas. The results of the teacher and student surveys are included in Appendix B.

The high school principal, high school department heads and district curriculum director reviewed the data during a half-day special meeting. Based on the review, this group decided to propose a sequence of special units designed to cover the topics rated most important by parents, community representatives, teachers and students. The plan developed to meet these needs is described in a subsequent section of this document.

Of the nine teachers who will be asked to participate in the program, only two have indicated that they have had adequate trainng to teach the designated environmental units. Therefore, the plans include a strategy to deal with this teacher training need.

During the July meeting of the district school board, the curriculum director reviewed the results of the annual standardized achievement test. A summary of the information on the environmental needs assessment was also reviewed. As a result of these presentations, the school board directed the superintendent to take the appropriate steps required to help improve high school reading scores, elementary school math scores and to initiate a program to respond to the environmental education needs. These three areas were designated as the top priority concerns for the district during the next academic year.

Example Three should get YES answers to most of the questions on the checklist. It's an owl.

A good needs assessment doesn't have to have a YES answer to every item on the checklist. Generally speaking, the more YES answers, the better the needs assessment.

TEN CONSIDERATIONS

Discussions of needs assessment frequently frustrate and confuse persons interested in doing a needs study for the first time. A typical reaction is: "Why does it have to be so complex? The needs are so obvious, they shouldn't be so difficult to document." Part of the problem is that the demand for objective public accountability in social programs is fairly new. Several years of trial and experience will be required before accepted procedures become established. Before we describe a procedure for conducting a needs assessment study, ten ideas should be considered.

Comments don't establish local needs. Quotations and summaries of statements from national and state celebrities can be included in a local needs assessment, but they don't establish local needs. General statements from national or state leaders are used to justify the importance of the area of need that was studied. Local schools and human service agencies have won the battle on this point. They don't want outside experts generalizing from national or state information and telling them how to run the local shop. If we agree that it is foolish to generalize to local units from national and state trends, we obligate ourselves to document the unique local condition.

Needs Assessment can take a long time and cost a lot of money. If you are an experienced and realistic professional educator, you are probably shaking your head, thinking "WOW" and seeing dollar signs and a wall full of calendar pages.

You're right!!! A complete needs assessment can be expensive and take a lot of time.

For example, Lewis' (1977) report on five case studies of general district-wide educational needs assessment studies in Ohio indicated:

a. The cost varied from $5,500 to $23,400.

b. Time demands ranged from 80 to 360 hours of the director's time plus clerical and consultant time over a period of up to one year.

c. None of the five school districts completed every step of the recommended needs assessment procedure.

The report of a National Institute of Education funded study of needs assessment techniques reported another five case studies of general educational needs assessments (Witkin, 1975). In these cases:

a. Costs varied from $500 to $20,000.

b. The studies were conducted over a period of a few weeks to two years.

c. Although generally satisfied with the results, most districts would have modified the procedures somewhat if they had to do it again.

But wait, don't throw in the towel!!! There can be time and cost shortcuts. We'll discuss this topic in Chapter 2.

Schools and local agencies seldom have the time or money to do a complete needs assessment. Some of the case studies reported by Lewis and Witkin were projects funded by state or federal agencies. Some were attempts to test idealized procedures for needs assessment.

Few of us can afford to be academically pure. As someone once said, "Why should we spend that kind of money to prove to others what a bad job our schools are doing? We have enough problems with inflation and shrinking budgets."

But remember, most real needs assessments will be approximations of the ideal. You have to make choices about what steps to include.

Educational needs assessments identify unfulfilled needs — not basic needs. Most "experts" agree that a needs assessment should identify unfulfilled needs, or what's missing. A listing of the basic educational needs of everyone is most often called a list of educational goals or objectives. When we confuse unfulfilled needs with universal objectives or basic needs we will hear ourselves say things such as, "Just because our kids do very well in math doesn't mean they don't need math."

To help emphasize this concept, Chapter 2 will be called, "How to do a Needs Assessment: Identifying Unfulfilled Educational Needs."

Educational programs must continue to meet the "basic needs" they are currently satisfying. But don't confuse that with the needs assessment process. Needs assessment is concerned with finding discrepancies, the difference between what currently exists and what is judged to be acceptable. Needs exist when something is missing.

Needs depend on values. In order to identify an unfulfilled educational need, we have to know what is adequate or satisfactory. That's a value judgment, not an absolute. A satisfactory level of educational attainment cannot be established in the same way we establish a minimum daily requirement for vitamin C.

WE HAVE TO RELY ON JUDGMENT — SOMEONE'S VALUES. WHOSE VALUES?

Students, parents, teachers, administrators, community groups . . . their values differ and often conflict.

REMEMBER, VALUES CAN CHANGE.

A new experience, insight that wasn't there before, major state or local events . . . All of these things can change opinions about what is desirable or adequate.

Don't be surprised if an environmental awareness program is the new experience that will change the majority opinion about what is satisfactory. An awareness program might result in a shift or change in the local educational needs without having any impact on the facts about current levels of student knowledge, skills and attitudes.

There are many models for educational needs assessment. There are many approaches for conducting an educational needs assessment. Chapter 3, "Needs Assessment Models," lists several models and briefly describes recommended procedures. Most models use one or more of three general strategies.

One strategy is to set priorities for goals. Some specialists believe a needs assessment should

involve representatives from various client groups in setting priorities for educational goals and objectives. The highest priority goals and objectives represent the greatest educational needs.

Goal setting is sometimes the only strategy used in a needs assessment. But the result is frequently considered to be an incomplete needs assessment by people responsible for allocating money to improve educational programs. However, other individuals see the approach as highly desirable because it identifies what is believed to be the "true need." There is some evidence to suggest that it is a reasonable approach because needs assessments using more elaborate strategies frequently find that the most important needs and the most important goals are the same.

A second strategy is to use group interaction. A variety of group activities can be used, such as rating goals and objectives or reviewing test scores. If you use group meetings you should have training and skill in small group dynamics.

Educators using group interaction techniques frequently report a high degree of confidence and satisfaction with the results. However, group interaction can produce conflict and sometimes generates vague statements.

A third strategy is to rely on questionnaires. A needs assessment may use questionnaires to survey parents, general community members, teachers or students. It may rely totally on the data from a questionnaire. Although some educators are very satisfied with this strategy, others have reported a lack of confidence in the results. One reported problem with the questionnaire strategy is that ratings are made without good information about current conditions and without adequate consideration of what is acceptable.

It is difficult to get agreement on what constitutes a demonstration of need. People who have written about educational needs assessments agree that a need is an undesirable deficit. A needs assessment is a set of activities that help document and describe important needs. But there are many different ideas about how to conduct a needs assessment. We gave you a sneak preview of three strategies. These strategies have been strongly criticized from a philosophical as well as a usefulness point of view. Some common reactions to specific needs assessments include:

What do students and parents know about educational needs? They don't have enough information or the right point of view to know what's really needed.

Professional educators are the only ones who have the training required to identify the real educational needs.

Those look more like wants than needs. Just because they want something doesn't mean they need it.

Those aren't needs; needs must deal with learner objectives. Teacher training, materials, money, new facilities and new programs are means of helping to meet the needs.

It's nice to have a group of teachers and parents reach a consensus, but reaching a consensus on the important educational goals doesn't tell us what our needs are. We are already meeting most of those important goals. A needs assessment should tell us where we should put more effort.

It doesn't do us any good to identify needs that we can't do anything about. A needs assessment should be limited to those things that have a reasonable chance of being changed.

The arguments go on and on.

What's the point? The point is: don't expect to do the one perfect needs assessment that will please everyone. But remember —

Someone must plan a program to meet the needs and administrators must approve the program plan. Make sure that the planners and the administrators get needs assessment information they are willing to believe.

Needs assessment should be used for program planning. Too often programs are planned without a clear idea of what will change as a result of the program. Program planning is based on the good ideas of a few highly interested professionals. Many times such programs are "just what the doctor ordered." But they can also miss the mark.

A needs assessment is intended to provide the foundation for planning a program. Once the needs are identified, you are in a better position to build a program that will have impact.

This is not as easy to do as it is to describe. Before you sink a lot of resources into a needs assessment, you should review the procedure to be sure it will produce useful information.

You should feel comfortable with the answer to the question:

"WILL THE NEEDS ASSESSMENT GIVE US INFORMATION THAT CAN BE USED TO HELP PLAN THE PROGRAM?"

Needs assessment data should assist program evaluation. When a good program is designed to meet unfulfilled needs, one result should be a reduction in the needs. A program can be evaluated, in part, by documenting the extent to which a need is reduced. Often the same instruments can be used for both needs assessment and evaluation. The needs assessment data can be seen as baseline or pre-test information. If a change in the positive direction is found, the program can be judged to be successful.

If a good program reduces need, we don't always conclude that the program should be dropped just because the need was satisfied. Some good programs will be continued in order to insure that the deficits do not reappear.

There are existing instruments and guidelines. The majority of existing needs assessment models were developed as general tools. They were not produced specifically for assessing needs for environmental education programs. However, many of the models can be used for environmental education and publishers have resource kits available upon request (see Chapter 3, p. 19).

The general models won't provide the instruments required for an environmental education needs assessment. Instruments usually have to be developed specifically for a particular needs assessment. But you can borrow from instruments used by other projects. Copies of some sample pages from instruments are contained in the second volume of this manual. These instruments can be a big help. You may be able to use some instruments "as is" or may want to modify them to meet your specific requirements.

Identifying Unfulfilled Educational Needs

The second chapter describes recommended steps for doing a needs assessment. Some steps will require you to construct instruments, select samples, etc. The appendix contains some pointers and suggests a few references that may be useful. Remember, with any recommended needs assessment procedure, you may want to drop or modify some steps. But try to make your needs assessment report an owl — not a turkey.

The recommended procedure consists of six major steps. Each step requires several activities. We'll explain each step and list the activities.

STEP ONE: ESTABLISH TIME AND COST LIMITS

STEP TWO: SET THE BOUNDARIES: WHOSE NEEDS AND THE AREA OF NEED TO BE STUDIED

STEP THREE: GATHER INFORMATION ON THE CURRENT LEVEL OF PERFORMANCE

STEP FOUR: ESTABLISH ACCEPTABLE LEVELS OF PERFORMANCE

STEP FIVE: ASSIGN PRIORITY TO THE IMPORTANCE OF NEEDS

STEP SIX: COMPARE ENVIRONMENTAL EDUCATION NEEDS WITH OTHER LOCAL NEEDS

STEP ONE - ESTABLISH TIME AND COST LIMITS

Before you get started on the needs assessment, you should answer three questions. When is the report due? What professional staff are available to help? How much money can you spend?

There may already be answers to these questions -- a specific total budget and due date are established. On the other hand, you may be asked to request a budget and propose a due date. In either case you should develop a time and cost estimate. A short lesson on time and cost estimation is included as part A of the Appendix (p. 38). This procedure requires you to know how to do a needs assessment and who will work on the study. Once you have the time and cost estimate you are prepared to begin some serious negotiations with "the boss" and to modify your planned procedure in order to stay within the available time and money.

Step One
Establish Time and Cost Limits

ACTIVITIES

a. **Identify the initial time and cost limits if they exist.**

b. **Identify people who will work on the needs assessment.**

c. **Outline a plan for conducting the needs assessment.**

d. **Develop a time and cost estimate (see Appendix, part A, p. 38).**

e. **Review the time and cost estimates with "the boss."**

f. **If necessary, negotiate procedures and revise the plan to stay within the time and cost limits.**

STEP TWO - SET THE BOUNDARIES: Whose Needs and the Kinds of Needs to be Studied

When you decided to do a needs assessment you already had a general idea about the area of need to be studied. You may already have had a specific program in mind and wanted to find out if there was a matching need. You have to decide if Step Two is appropriate for your situation.

If you have only a general idea of the area of needs to be studied, Step Two can cause a lot of

worry. You can't cover everything. But how can you be sure that one of the more important needs isn't overlooked? The obvious answer is to start with a good review of the literature from which a list of concerns can be built. But is that enough?

There are no guarantees, but perhaps the next best activity is to establish a needs assessment advisory committee. The committee can react to your plans and early work. They will have insights and points of view you may have overlooked. Although it takes time to work with a committee, it will be reassuring to know your work is progressing along the right track. The committee can help you decide whose needs and what kinds of need should be studied.

An educational needs assessment will always address learners' needs. But who are the learners? — All the kids in school? The high school students? Parents? Members of special community groups? All the citizens in the county? What about teacher **training needs, material needs, space needs,** etc.?

Experts argue about different kinds of needs. Some say teacher training, materials, space, etc., are not educational needs but are alternative solutions for meeting needs. Other experts say these are important process needs and can't be ignored.

The difference between needs and potential solutions is all a matter of perspective.

It's an academic argument. Each side of the argument has its merit. Suit yourself but decide, with the help of the advisory committee, whose needs and what kinds of needs are to be explored.

A good knowledge of environmental education is a help in establishing the areas of need to be explored. This is where expert testimony comes in handy. The opinion of experts can be used in identifying the areas that will be explored.

There are several general needs assessment resources containing pointers on how to work with needs assessment advisory committees. You may want to obtain copies of one or more of the following resources:

Facilitator Training Module for the Human Processes of Needs Assessment, Department of Education Research and Planning, Columbus Public Schools, Columbus, Ohio 43215.

Needs Assessment Kit, Diagnostic and Prescriptive Center for Educational Environments, 1210 Thirteenth Street, Parkersburg, West Virginia 26101.

The School and Community - Partners in Education, Office of Fresno County Superintendent of Schools, 2314 Mariposa Street, Fresno, California 93703.

The Phi Delta Kappa Goal Rating Workshop Packet, Phi Delta Kappa, Inc., Commission on Educational Planning, P.O. Box 789, Bloomington, Indiana 47401.

Needs Assessment Resource Book, Worldwide Education and Research Institute, 2315 Stringham Avenue, Salt Lake City, Utah 84106.

Step Two
Set the Boundaries

ACTIVITIES

a. **Carefully review the available literature. Find out what environmental education experts have considered important.**

b. **Compile a list of potential areas of concern.**

c. **Obtain suggestions for consideration by members of the needs assessment advisory committee. (Don't get people who all think alike — be brave and risk a little group disagreement.)**

d. **Select and convene the advisory committee to react to your time and cost estimates, lists of whose needs and the kinds of needs to be studied.**

STEP THREE - GATHER INFORMATION ON THE CURRENT LEVELS OF PERFORMANCE

Most educators find it difficult to identify desired levels of performance without knowing existing levels of performance. Many models suggest establishing the desired levels first. That may be okay in theory, but it just doesn't work very well. Based on the results of case studies and past experience it is better to start with data on current levels of performance.

What kind of data? You will want knowledge, skill and **attitude** data.

How do you get the data? This is a problem because the collection and processing of data is **expensive.** It is often better to use existing data that is close to what you want than to try to collect new data.

If you work with a school, review existing data files. There may be parts of annual achievement tests and/or attitude inventories that can be used. Check to see whether someone else has collected any usable information such as records of student work, activities and field trips, etc. Sometimes an analysis of the current school curriculum may show a lack of environmental education content. Records of available instructional resource materials can also be useful.

If you decide you should collect new data such as test scores, attitude inventories, etc., then what? You should consider three things: **instruments, samples,** and **data analysis.**

Most experts suggest planning to collect new data from a sample of the **who** in **whose** needs. Often it is not necessary to collect data from everyone. Before you select a sample, you must have a list from which the sample is selected. (For those interested in the language of sampling, the list is called a sampling frame.)

How large should the sample be? Usually a sample of 200 to 300 from each group (students, parents, teachers, etc.) is large enough. In general, the larger the sample the better. If your "who" group is very small, say less than 200, a sample of half of the group is usually adequate.

In most cases it's best to select a random sample. A set of instructions for selecting a random sample is included as part B of the appendix (p. 41).

What about instruments, tests, attitude scales and opinion surveys? The easiest thing to do is to use one of the instruments from the set of examples included in Volume Two. But most educators will want to adapt the existing instruments to fit their unique situation. A set of suggestions for constructing and/or modifying instruments is included as part C of the appendix (p. 42).

After you select your sample and instrument, you have to get the responses. Special arrangements must be made with school officials or other authorities in order to obtain permission to collect the information.

In some cases you may decide to mail the instrument. If you mail questionnaires you can expect to get approximately one-third of them returned. But maybe you can do better. Here are a few suggestions:

1. Don't crowd the questions on the paper. Leave plenty of blank space.

2. Use colored paper.

3. Pilot test the questionnaire with five to ten people to be sure the questions are clear and don't offend anyone. If your pilot test indicates it takes longer than ten minutes to respond, the questionnaire is too long.

4. If your questionnaire is long (takes from 10 to 20 minutes to answer), you might first send a letter and self-addressed stamped postcard. Ask the people in the sample if they would be willing to respond to a questionnaire related to your topic and to return the postcard indicating their willingness to participate. Once a person promises to answer the questionnaire he is more likely to return the survey instrument. You may get as many as two-thirds of the mailed instruments returned.

An extremely common error is failure to plan the data analysis procedure before the new data are collected. There are boxes of completed tests and questionnaires stacked in closets, basements and trash cans — just sitting there — not being processed because someone forgot to plan the data processing procedure before the data was collected. They discover it is much too costly to process the data or there is no convenient way to analyze the data so that it provides useful information.

Often the analysis can be a simple summary, a count of the number of responses to each alternative for a specific question. You may want to calculate percentages and averages. (See part D of the appendix for some pointers on calculating averages.)

You should always test your data analysis plan by using the returns from the pilot test of your instrument. Go through the procedure. Does it work? Can you get meaningful information from your results? If not, you will want to change the instrument or the data analysis plan in order to get meaningful information.

PLEASE!
DON'T NEGLECT THE PILOT TEST!

When time pressures and the boss are on your back you will be tempted to charge ahead. Be careful — you may get shot down.

A few suggestions for data analysis are included in part D of the appendix (p. 45).

NOTE: It may be useful to get similar data from what you consider to be appropriate comparison groups. In some cases, reports from other environmental education programs can be used.

Step Three
Gather Information on the Current Level of Performance

ACTIVITIES

a. Search for existing data.

b. If needed, do a special analysis of existing data.

c. Prepare summary reports of exisiting data.

If new data is required:

d. Review existing instruments.

e. Modify existing instruments or construct new instruments.

f. Pilot test the new instruments.

g. Design the data analysis procedures.

h. Pilot test the data analysis procedure, then revise the instrument or analysis procedure as necessary.

i. Construct a list of the target group(s).

j. Determine the sample size you will use.

k. Select the random sample(s).

l. Collect the new data.

m. Analyze the new data.

n. Prepare summary reports of the data analysis.

Don't forget to consider:

o. Prepare summary of data from appropriate comparison group(s).

STEP FOUR - ESTABLISH ACCEPTABLE LEVELS OF PERFORMANCE

After you have appropriate knowledge, skill and attitude data, it is easier to establish desired levels of performance. It helps to have similar information from appropriate comparison groups.

Select a wide range of people such as students, teachers, administrators, parents, community agency representatives and/or the general population to review the data.

The resource guidelines on group interaction listed in Step Two will also be useful with this activity. Discussions that focus on the data summaries can result in some level of agreement on acceptable performance levels. You will have better luck if you select people who have some knowledge of the areas being assessed. Be careful; there is no right or wrong decision. The question concerns values; these are opinions. Be careful not to stack the review team in favor of one segment of the community or you may find that your results are rejected.

If unresolved conflicts persist, you and your boss may have to select from among the different opinions. But if you have good group leadership skills, things should go smoothly. You may want to use a round-robin procedure.

a. Ask every member of the review team to first examine the data and to record their opinions on whether the data indicates the performance is:

   1. better than what should be considered acceptable.

   2. just about what should be considered acceptable.

   3. lower than what should be considered acceptable.

b. Tabulate the responses and identify those items of general agreement.

c. Discuss the items of disagreement and vote again.

Repeat this procedure until movement toward concensus stops.

Identify those items for which it is generally agreed that the present performance is at about the right level. Mark these items as zero deficiency items.

Identify those items for which there is general agreement that the current level of performance exceeds the acceptable level. Mark these as over-achievement items.

Use the modified round-robin procedure to set an acceptable level of performance for the remaining items. Repeat the discussion/voting activity as often as necessary in order to reach consensus on the acceptable level. Identify these items as needs and determine the magnitude of the deficiency.

Note of interest: Some models combine Steps Three and Four into one activity, a survey of perceived need. Such surveys ask the sample to rate the level of perceived need on a series of objectives. In some cases, the survey instrument asks for two ratings: first, a rating of the level of importance of each objective, and second, a rating of the perceived level of current performance. In this latter case, the same rating scale is used for both responses, a difference between the two average ratings is calculated and is called the deficiency score.

Step Four
Establish Acceptable Levels of Performance

ACTIVITIES

a. Identify potential members of the review team(s).

b. Select members of the review team(s).

c. Schedule and conduct meetings to:

1. Identify acceptable levels of performance.

2. Identify the items as zero deficiencies, over-achievements or needs.

d. Prepare a report on identified needs.

STEP FIVE - ASSIGN PRIORITY TO THE IMPORTANCE OF NEEDS

Once the needs are identified, they should be assigned priorities. The size of the deficiency may not be related to the importance of needs. Items with small deficiencies may be rated as greater needs than items with bigger deficiencies.

The priority rating task can be given to groups used for earlier steps or a new group of individuals. These persons should be asked to rate the importance of reducing need.

If the number of need items is small (less than ten) the raters may find it easier to **rank** the items. The advantage of **ranking** is that it forces the respondents to give different scores to each need.

If the number of needs is more than ten, **rating** is usually more satisfactory. It may be useful to give each rater a **fixed** number of rating chips of specific value. For example, if they are asked to rate 25 items on a five point rating scale each member of the rating team can be given five 1-point chips, five 2-point chips, five 3-point chips and so on. This procedure will reduce the number of ties and produce a greater spread in the scores obtained when summing the ratings for each item.

If you have a large number of needs, say 35 or 50, you probably will want to use a simpler process. In such cases, it is better to use a 15-point rating scale. The width of the scale will help produce a bigger difference between the items when the ratings are summed. Each person uses the scale to rate every item: For example:

Need

Importance of reducing the need

Low High

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Acceptable Level: 70% of high school students can identify fossil fuels and non-renewable sources of energy.

   Current Level: 32% of the high school students correctly answered the questions concerning fossil fuels. 36% of the high school students correctly answered the questions concerning non-renewable sources of energy.

Need

Importance of reducing the need

Low High

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

2. Acceptable Level: 50% of high school students have conducted or reviewed an environmental impact study.

   Current Level: 6% of the high school students have conducted or reviewed an environmental impact study.

A priority order is obtained by ranking the items on the basis of the sum of the ratings.

Step Five
Assign Priority to the Importance of Needs

ACTIVITIES

a. Select the priority setting group.

b. Decide on the priority setting activity.

c. Conduct the priority setting meeting(s) and obtain rankings.

d. If there is a good deal of disagreement about the priority rankings, you may want to conduct a discussion session based on the results of the first ratings and enter into a second round of rating activities.

e. Prepare a report of the priority ratings.

STEP SIX - COMPARE ENVIRONMENTAL EDUCATION NEEDS WITH OTHER LOCAL NEEDS

Some agencies (local, state, private or federal) will want to know how the environmental education needs compare to other local needs. If they are far down the line, there is a concern that the program won't get the local support required to make it a success.

One method of assessing the relative importance is to ask local agency administrators or school boards to rate the importance of the environmental education needs. A five-point or seven-point rating scale can be used. You only have to ask for one rating from each individual. For example:

AFTER EXAMINING THE ATTACHED LIST OF PRIORITIZED ENVIRONMENTAL EDUCATION NEEDS, HOW WOULD YOU RATE THE IMPORTANCE OF THESE NEEDS IN RELATION TO OTHER NEEDS OF THE SCHOOL DISTRICT (COMMUNITY)?

1	2	3	4	5	6	7
Low Relative Importance						High Relative Importance

The ratings are then tabulated indicating the number and percentage of those who circled each rating level.

Step Six
Compare Environmental Education Needs with Other Local Needs

ACTIVITIES

a. Prepare brief executive summary statements of the prioritized environmental education needs.

b. Prepare a rating scale (1 question).

c. Arrange for and collect the ratings.

d. Tabulate the ratings.

PARTING REMARKS

The six step needs assessment procedure should give you usable needs assessment information. It isn't perfect. Some people may find fault with some of the procedures and consequently question the validity of the needs assessment. You may want to drop some activities and substitute or alter some of the steps or activities. Go ahead!! Do your own thing. You'll be more satisfied with the results.

A few parting remarks may be worth your attention.

1. Take extra care to make sure you do not bias the results of committee work by selecting only participants who agree with the results you expect.

2. Don't try to do more than you can handle. One small assessment well done will be more useful than a major effort that is never finished.

3. Use the recommendations of advisory teams. Make sure they know how their recommendations were used. Failure to use their ideas or failure to let them know how you used their ideas will result in loss of credibility and may cause a political, psychological or even physical attack. Don't play games with your interested constituents.

4. Be prepared to modify some of your own values and opinions. Once you open the door to shared decision making, you are obligated to be democratic. The majority may be "wrong" but you have to go along with it most of the time.

5. Be sure to get support by involving key administrators and other influential persons in all aspects of the need assessment project. Make sure they are kept well informed of every step and have a clear understanding of all procedures in order to be consistent with their notions and recommendations. Attention to this caution should result in a greater degree of local ownership in the needs assessment and will increase the believability of the results. When administrators and key influential individuals are not involved in the process, there is a greater probability they will place a low degree of trust or belief in the results and will ignore your work.

OUTLINE OF NEEDS ASSESSMENT STEPS AND ACTIVITIES

Step One - Establish time and cost limits

a. Identify the initial time and cost limits if they exist.

b. Identify people who will work on the needs assessment.

c. Outline a plan for conducting the needs assessment.

d. Develop a time and cost estimate.

e. Review the time and cost estimates with "the boss."

f. If necessary, negotiate procedures and revise the plan to stay within the time and cost limits.

Step Two - Set the boundaries: whose needs and the area of need to be studied

a. Carefully review the available literature. Find out what environmental education experts have considered important.

b. Compile a list of potential areas of concern.

c. Obtain suggestions for people to be considered as members of the needs assessment advisory committee. (Don't get people who all think alike — be brave and risk a little group disagreement.)

d. Select and convene the advisory committee to react to your time and cost estimates, list of whose needs will be considered, and list of potential areas of concern.

e. Revise your plan and meet with the advisory committee again, if required.

Step Three - Gather information on the current level of performance

a. Search for existing data.

b. If needed, do a special analysis of existing data.

c. Prepare summary reports of existing data.

d. Review existing instruments.

e. Modify existing instruments or construct new instruments.

f. Pilot test the new instruments.

g. Design the data analysis procedures.

h. Pilot test the data analysis procedure, then revise the instruments or analysis procedure as necessary.

i. Construct a list of the target group(s).

j. Determine the sample size you will use.

k. Select the random sample(s).

l. Collect the data.

m. Analyze the data.

n. Prepare summary reports of the data analysis.

Step Four - Establish acceptable levels of performance

a. Identify potential members of the review team(s).

b. Select members of the review team(s).

c. Schedule and conduct meetings to:

1. Identify acceptable levels of performance.

2. Identify the items as zero deficiencies, overachievements or needs.

d. Prepare a report on identified needs.

Step Five - Assign priority to the importance of needs

a. Select the priority setting group.

b. Decide on the priority setting activity.

c. Conduct the priority setting meeting(s) and obtain rankings.

d. If there is a good deal of disagreement about the priority rankings, you may want to conduct a discussion session based on the results of the first ratings and enter into a second round of rating activities.

e. Prepare a report of the priority ratings.

Step Six - Compare environmental education needs with other local needs

a. Prepare brief executive summary statements of the prioritized environmental education needs.

b. Prepare a priority rating scale (1 question).

c. Arrange for and collect the ratings.

d. Tabulate the ratings.

Two of the better resource documents on needs assessment models were prepared by Belle Ruth Whitkin of the Alameda County Schools in Hayward, California and by the New Jersey Department of Education, Division of Research Planning and Evaluation. Whitkin's report, **An Analysis of Needs Assessment Techniques for Educational Planning at State, Intermediate and District Levels,** 1975, was the product of a project funded by the National Institute of Education and made a major contribution to the literature on needs assessment. The New Jersey Department of Education publication, **Modelog: A Catalog of Comprehensive Educational Planning Component Models,** 1975, is a compendium of descriptions of 107 models for educational goal setting, preparation of objects, assessment, program selection, evaluation for effectiveness and evaluation for efficiency.

A brief description of some of the more widely known models is provided below. These are general models for educational needs assessment and were not designed specifically for assessing needs for environmental education.

BATTELLE MODEL

The Battelle Center for Improved Education has developed a needs assessment service. They have prepared questionnaires but will work with a local agency to develop questionnaires to fit the Battelle format. The questionnaires usually ask for a double rating; a rating of "what should be" and a rating of "what is."

Battelle provides an instrument scoring service and has developed computer printouts that provide detailed information on responses. They have the capability of separating responses by groups of respondents such as administrators, teachers, students and parents.

Contact: Battelle Center for Improved Education
505 King Avenue
Columbus, Ohio 43201

ESA NEEDS ASSESSMENT PROCEDURE

The Educational Systems Associates have developed a loose-leaf manual describing procedures to be considered in planning a comprehensive needs assessment study. The proposed model uses three types of measurement: a survey of perceived needs, an analysis of secondary data sources and the direct measurement of the existing status. Both learner objectives and process objectives are recommended for assessment.

Contact: Educational Systems Associates
300 East Huntland Drive
Austin, Texas 78752

FRESNO MODEL

The Fresno model was developed by the Office of the Fresno County Superintendent of Schools, Fresno, California. A description is contained in the booklet entitled **The School and Community - Parents and Education.** It contains descriptions and flow charts for community conferences to identify needs and goals. There is also a film strip and/or cassette orientation. Like some other models, the Fresno Model relies heavily on a conference of key participants. It focuses on two questions: "What are the things that are keeping our schools from doing the job they should be doing for students?" and "What are the things our schools should be doing for students in this community?" The Fresno Model recommends conducting several conferences involving parents, teachers, students and other individuals in interactive small groups. After several conferences, the common statements are sorted into categories and reviewed by a steering committee. The committee is involved in selecting goals and objectives and in developing programs to meet them.

Contact: Office of the Fresno County Superintendent of Schools
2314 Mariposa Street
Fresno, California 93721

PHI DELTA KAPPA MODEL

The Phi Delta Kappa Model was developed originally by Northern California Program Development Center. It consists of a goal rating procedure. Phi Delta Kappa sells workshop packets that contain

a variety of materials that can be used in interactive workshops. The materials are used to assist individuals in arriving at the priority rankings of goals and objectives. After consensus ranking of goals is achieved, committee members rate how well the current school programs are meeting each goal. Although the model provides a specific set of goals, individual users have the option of adding other goals when appropriate.

Contact: Phi Delta Kappa, Inc.
Commission on Educational Planning
P.O. Box 789
Bloomington, Indiana 47401

WORLDWIDE MODEL

The Worldwide Education and Research Institute has developed a set of ten manuals and a set of film strips and cassettes. The central feature of the model is a "concerns analysis." This provides a procedure for integrating perceptions and judgments with test scores and other objective data to arrive at a consensus on need areas. Detailed instructions are given for comparing facts, policies and values to arrive at statements of "validated" needs. Personnel from Worldwide Associates are also available as consultants to assist with the process.

Contact: Worldwide Education and Research Institute
2315 Stringham Avenue
Salt Lake City, Utah 84109

COMMENT ON MODELS

There are a number of other models that have been widely used. These models are described by the Whitkin and the New Jersey reference documents but are not described here because they aren't easily adapted to special areas such as needs for environmental education.

Inquiries regarding the Whitkin Report "An Analysis of Needs Assessment Techniques" should be addressed to Dr. Belle Ruth Whitkin, Research and Evaluation, Alameda County Schools, 685-A Street, Hayward, California 94541. Inquiries regarding the New Jersey Modelog should be addressed to Assistant Commissioner, Division of Research Planning and Evaluation, State of New Jersey, Department of Education, 225 West State Street, Trenton, New Jersey 08265.

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Let's assume you did a good job in documenting the need for an environmental education program and developed a good plan.

NOW YOU'RE READY TO DEAL WITH EVALUATION

You're probably in one of two situations:

a. Preparing a proposal and having to include an evaluation design

b. Working with a new or established environmental education program and having to include evaluation information about the program

Each of the two situations requires special **evaluation skills.** But first — let's consider a few basic concepts.

We've all heard the phrase "it's just the tip of the iceberg" and have experienced the phenomenon with jobs. There is always more to a particular job than is visible from the outside looking in. The same is true with evaluation. Evaluation is a highly elastic concept. It is stretched to cover many kinds of informal judgments and collections of information.

The literature of educational evaluation is filled with specialized vocabulary describing complex concepts. We can avoid most of the technical words, but a few are important. Most educators equate the term "evaluation" with the process of making judgments about student learning. That's an important and complex kind of educational evaluation, but it's only a part of what is included in program evaluation. Two of the more meaningful evaluation concepts describe two distinct **roles** of evaluation: **SUMMATIVE** evaluation and **FORMATIVE** evaluation.

SUMMATIVE ROLE

The summative role of evaluation is the easiest to understand — it deals with judgments about the worth of the programs.

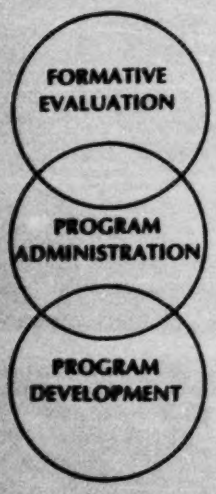
These judgments are used to justify decisions on whether to integrate a tested program into other school or community activities and decisions to either continue or discontinue use of public funds for an existing program. The summative evaluation should tell us if the program helped to reduce the identified needs. Part F of the appendix (p. 53) describes summative designs.

SUMMATIVE EVALUATION ANSWERS QUESTIONS ABOUT PROGRAM WORTH

The information from summative evaluation is intended not so much for use by program staff but for administrators who make and defend program funding and continuation decisions. It allows them to account for what is taught and for how they use public resources.

FORMATIVE ROLE

The concept of formative evaluation is more difficult to grasp. Perhaps this is because formative evaluation overlaps the activities of program administration and program development.



The formative role of evaluation is to **IMPROVE** and **SHAPE** the program while it is being developed.

The results of formative evaluation are intended to be used by program staff. Program administrators and developers use formative evaluation to identify adjustments or changes that will improve a program. When we gather information to determine if the staff are staying on schedule and using their time and resources wisely, or collect information about the appropriateness of instructional materials, we are doing formative evaluation. This information can tell us how we should modify staff activities or instructional materials. Much of what we expect of good administrators or developers is called formative evaluation.

You may wonder why we call these activities "evaluation" when they are really a part of good program administration and development. Let's not worry about what we call it. Let's just be satisfied with saying "that's the way it is," logical or not. The **important** thing is that we get the job done, not

what we label the job. If you're really interested in "**why?**" - the history of educational evaluation - there are several evaluation texts that provide a chapter or two on the topic.

PROGRAM DIVERSITY

Environmental education projects come in a variety of sizes and are designed to meet a wide range of educational needs. A recent study of federally funded environmental education programs produced brief descriptions of the essence of about 200 projects. These included projects such as:

Teacher's Guide for Social Studies/Science Curriculum

Workshop for Integrated Pest Control

Plans for Building Windmills: Construction of an Environmental Curriculum Guide

Teacher Resource Kit on Population Growth

Classroom Development of Student Awareness of Current Environmental Problems, followed by a Wilderness Survival Campout to Practice Environmental Skills

Secondary School Program Involving Values Clarification Techniques and Their Relevance to Current Environmental Issues

Workshops in Environmental Legislation with an Emphasis on Lake Water

Community Workshops on Reclamation of Oil Fields

County Level Growth, Explored through Workshops on Land Use Planning; Workbook for Community Networking Related to Hard Rock Mining

Workshops on Jobs and Energy: Booklet on "Guide to Employment Impact Statements"

Training of Community Coordinators to Explain Land Use Planning in Local Meetings

Workshops on Problem Assessment in Environmental Planning

Teacher Awareness Building, Consulting Sessions with Teachers to Encourage Expanded Environmental Education Activities, Newsletter

These activities will require many different evaluation strategies. Only a limited number of the possible data collection and analysis strategies can be presented in this manual. The alternatives presented are intended as a set of ideas to stimulate your creativity and help you design a unique evaluation plan for your particular situation.

Many evaluation techniques rely on **quantitative** information, i.e., information easily converted into numbers. It is objective because, for example, we can agree on how to count people who attend workshops, to determine scores on a set of tests, or to count the number of very good, good, average, poor or very poor ratings of a presentation.

Evaluations also rely on **qualitative** data. These data are not converted to numbers and sometimes can be given different value judgments by a group of reviewers. Examples include: descriptions of the interactions between program presenters and participants at a workshop, summaries of the major recommendations by a group of teachers and comments by experts on the accuracy of the content in a set of instructional materials.

In actual use, a great deal of evaluation information has characteristics of both qualitative and quantitative information and cannot be easily classified into either of the two categories. It is not important that we are able to accurately classify data as either quantitative or qualitative. The important thing is to remember to include both quantitative and qualitative information whenever appropriate.

Many of the examples of the evaluation strategies are presented in the context of a specific setting such as public schools or community workshops for adults. The same is true of many of the sample

instruments; that is, instruments which were originally designed for use with a specific group. If the examples or sample instruments don't match your particular situation, don't ignore them. Try to consider how a slightly modified procedure or slightly modified instrument could fit your particular environmental education program.

You won't have any problem remembering to gather data from your learners, but don't forget to consider collecting other data. Other data include information from or about administrators, teachers, parents, family members, community agencies and organizations, and animate or inanimate objects in the environment (vegetation, animals, water quality, air quality, etc.).

GENERAL PRINCIPLES

Whether you are evaluating a school building program, or have major responsibility for evaluating a community or school district program, there are a few general principles to keep in mind.

Principle 1: Don't collect more data than you will use. It's easy to get carried away with data collection — only to find you don't have the time or the resources to analyze everything. Try to answer the most important questions about your program.

The actual aggregation, analysis and interpretation of data is not as simple as it appears. The analysis procedure can be more demanding than the collection procedure. The trick is to be choosy.

Principle 2: Don't interrupt the ongoing activities of field personnel for data collection. Dedication to a good evaluation may cause the evaluation to appear more important than the program activities themselves. The process of data collection can interfere with or even destroy the intent of a set of program activities.

For example, if a program is attempting to build awareness of the need for environmental education within a school's staff, an evaluator may interfere by collecting detailed data on the extent to which teachers currently teach environmental education concepts in their classes. Before collecting data, consider possible impacts of the data collection process.

Principle 3: Never distribute questionnaires or tests without trying them out. Tryouts or pilot tests can be conducted with five to ten individuals similar to those who will be answering the questionnaire or taking the test. This procedure will eliminate ambiguous wording and other problems that could result in unusable data. When you pilot the questionnaire or test you should observe the respondents. Watch for body language that would indicate problems, then ask questions about problems with the instrument.

Principle 4: Always establish your data analysis procedure before collecting the final data. Far too many educators have collected data only to find they cannot aggregate or analyze the data in a meaningful way.

To be sure you can process the data and produce an evaluation result you should try the intended analysis strategy on the information collected while piloting the instrument. This process may also help you discover new or better ways to analyze the data. See parts D & E of the appendix (p. 45 and p. 49).

Principle 5: Consider the persons who will use the results of your evaluation. Many administrators are concerned about being "boondoggled" by program advocates. If you expect someone to take some favorable action in behalf of your program, make sure you use strategies they understand and collect information they think is important. Administrators won't make decisions in your favor unless they are comfortable with the information. For example, don't tell them how many teachers thought the program was very good if they really want to know how many teachers are using the program.

Principle 6: Make sure the formative and summative evaluation information can be used. Sometimes we gather information that is "nice to know" but can't give a good answer when someone asks "so what?" We have useless information.

Outline possible results from the data, then decide who would use the information and what possible actions they could take as a result of the information. If you can't provide a quick, short and relatively simple answer to the "so what" question, the information may be useless.

Always limit your evaluation studies to the unanswered questions. Don't provide information that no one wants to know. This unwanted information may relate to issues that have already been decided or to conditions not subject to change. Sometimes administrators have already made up their minds about certain issues. They don't want additional information that might cause them problems. If an issue is already decided in their own minds and they have taken a public stand on the issue and you gather more data, they will have one of two responses. If your information disagrees with their position, they will attack the appropriateness and accuracy of the evaluation. If the information agrees with the position they've already taken, they will accuse you of wasting time and money. When an administrator or program developer has decided, the issue is closed.

"When evaluation information is gathered about closed issues, no good evaluation will go unpunished."

IMPORTANCE OF EVALUATION DESIGN

By the time you are ready to consider evaluation design, you've worked long and hard to design a good environmental education plan. Your plan includes an owl of a good needs assessment, goals and objectives based on documented needs and activities structured to meet the objectives.

The process of designing an evaluation is much the same whether you are writing a proposal or are responsible for evaluation of an existing program. It's not difficult if you know what the program is supposed to do. Most educators can develop an adequate evaluation plan if they follow a few simple procedures.

If you're writing a proposal, a good evaluation design is doubly important because — well, you should know a little secret!

After all your hard work, your proposal may never be looked at very carefully — it may be stuck in the reject pile after only a few pages are read.

WHAT!!!

That's right! It may never really be considered.

THAT'S NOT FAIR!!!

Wrong!!

When a funding agency gets requests for three or four times the amount of available funds, it has to approve those proposals with the best chance for success. If one or more parts of your proposal are poorly prepared, the reviewers usually conclude the program will be poorly coordinated.

Some reviewers look at the evaluation design first. If it's poor or weak, they stack the proposal in the reject pile without further consideration. Even those who first look at the needs assessment, project design or budget will comment on the evaluation design.

Funding agencies report that more proposals are rejected because of poor evaluation designs than for any other reason. These agencies believe a good evaluation can do a lot to ensure a successful program.

Let's review an example of what is sometimes written for the evaluation section of a proposal. Does the example tell you the writer will be able to carry out an effective evaluation? You be the judge! Is it good — an owl, or bad — a turkey?

EVALUATION DESIGN - EXAMPLE ONE

Evaluation will be carried out throughout the project. The evaluation will focus on the impact of the project on four groups: teachers, students, community program participants and community leaders.

The evaluation will be conducted by the school services division of the College of Education, Grogan University, Lawson, Wyoming. Dr. Parkin will head the evaluation team.

Even without a guide or checklist for reviewing an evaluation design you should recognize this as a real turkey.

The design does mention **impact,** but doesn't tell us what will be done to measure the impact. The statement says nothing about formative evaluation.

Of course — an immediate key was that it was too short. Although length is not an adequate indicator of quality, we can usually conclude that the one or two paragraph evaluation statements are inadequate.

Whether it's an evaluation plan for a proposal or for other purposes, your plan should have **three components:**

1. **A formative evaluation component** including a listing of major formative evaluation questions and the data that will be collected.

2. **A summative evaluation component** including a description of the major data to be collected and how they will be processed.

3. **An evaluation work plan** including a description of when and how evaluation activities will be completed and who will have the major responsibility for evaluation.

Let's review another example. Does it contain all three components?

EVALUATION DESIGN - EXAMPLE TWO

The evaluation will be concerned both with the process of delivering the environmental education program and the results obtained. A continual effort will be made to monitor the extent to which the program is conducted as planned and to ensure that desirable modifications are identified and implemented. This continued monitoring is called formative evaluation and is described below. The program director and program staff will share this evaluation responsibility. The second thrust of the evaluation is intended to determine whether the program helps to reduce identified needs. This part of the evaluation is called summative evaluation and is described below. The summative evaluation will be carried out by the Research and Evaluation Division of the Blue Hill Board of Cooperative Educational Services.

Formative Evaluation

The formative evaluation is intended to ensure that:

A. Program staff obtain or develop the appropriate instructional materials and resources as scheduled and that the teachers deliver the environmental education program as planned.

B. The instructional materials and resources are adequate for use with the intended learners.

C. The instructional materials and resources are adequate to teach the desired knowledge, skills and attitudes.

Three types of information will be collected to address the formative evaluation issues:

A. The program staff will meet once a week during the first two months of the school year and twice a month thereafter. During these meetings, the staff will report their progress in identifying, adapting and developing environmental education instructional materials. They will also report their progress in meeting with teachers in order to identify opportunities for including environmental education concepts within existing courses. As determined by these progress reports, adjustments will be made in the program plan and staff assignments.

B. As materials are introduced into existing courses two types of information will be collected. Teachers will complete a short questionnaire about the materials. On appointed days selected classes will be observed by members of the program staff. The questionnaire and observation information will be used to identify desired changes in the materials and to identify requirements for additional materials or resources. The questionnaire will be a short open-ended instrument that asks teachers to recommend specific ways in which the materials can be modified and to comment about those portions of the materials they believe are most useful.

The observation will be used to identify and describe the ways in which teachers are using the materials and the types of responses received from students. A staff member will record short cryptic notes during the observation period and convert these into more detailed comments following the class period.

C. Student tests make up a third kind of formative evaluation data. Teachers will be asked to include selected questions into their unit tests. Copies of the student answer sheets will be forwarded to the program office. Students' answers to each environmental education question will be tabulated and analyzed to determine if any information is misunderstood. The analysis of the answers to each test question will be used to help identify problems in the materials and/or teaching strategies.

Summative Evaluation

The data for summative evaluation will not be collected until after the environmental education materials and instructional strategies have been tried and revised. The summative evaluation data will be gathered from different teachers and students, then used for the formative evaluation. Each class will be given a pre-test and a post-test. The class means on the post-test will be compared with those on the pre-test. A table will be prepared to show the amount of growth in the class mean from the pre-test to the post-test.

Based on previous experience with other educational programs, it is understood that some teachers will use the materials to a greater extent than others. To assess the impact of this variable on the amount of pre-test/post-test change, it will be necessary to measure the extent of program implementation in each classroom. A questionnaire will be given to teachers in order to determine the extent to which they used the suggested material or activities. Based on the results of the questionnaires, each class will be categorized as either a high user, moderate user, or low user. The amount of change on the pre-test/post-test means will be examined for classrooms placed in each category. If the program has a positive impact, there will be greater change in the means in the high user classes and the smallest change in the means in the low user classes.

If adequate evaluation designs are owls and poor designs are turkeys, Example Two would be ruffled and skinny — but still an owl.

Few evaluation designs will completely satisfy every reviewer, but adequate designs should have more good marks than bad marks. The checklist starting on the next page will give you an idea of what many reviewers look for when they read an evaluation design.

CHECKLIST for Reviewing Evaluation Designs

General: Does the design

(If there is insufficient information, check NO)

1. Include formative evaluation? (Other commonly used terms are process evaluation, design and installation evaluation.) YES ____ NO ____
2. Include summative evaluation? (Other commonly used terms are impact evaluation and product evaluation.) YES ____ NO ____
3. Describe how key administrators were involved in the development of the evaluation design? YES ____ NO ____

Formative Evaluation: Does the design

4. Describe what information will be gathered and used to help keep program development on schedule? YES ____ NO ____

5. Describe a procedure for altering the proposed plan if the project gets off schedule or cannot fully implement the plan? YES ____ NO ____

6. Describe the data that will be collected to identify desirable changes in program materials and program activities? YES ____ NO ____

7. If Yes to #6, will the information provide specific suggestions for change? YES ____ NO ____

8. Describe how the intended learners and teachers will suggest changes in the materials or activities? YES ____ NO ____

9. Describe how the program will provide for continuous week-to-week documentation of progress? YES ____ NO ____

10. Describe how the staff will demonstrate to "outsiders" that the program resources were used only for the intended purposes? YES ____ NO ____

Summative Evaluation: Does the design

11. Describe the summative data that will be collected? YES ____ NO ____

12. If Yes to #11, will the data provide a measure of the extent to which the program reduced the initial deficiency? YES ____ NO ____

13. Provide for measures of program impact on:
    (a) learners YES ____ NO ____
    (b) teachers YES ____ NO ____
    (c) administrators YES ____ NO ____
    (d) others YES ____ NO ____

14. Describe the data analysis procedure? YES ____ NO ____

15. Permit differentiation between the impact of the early version of the program and the revised versions of the program? YES ____ NO ____

Other Considerations: Does the design

16. Name the individuals responsible for collecting information? YES ____ NO ____

17. Indicate an approximate date for collecting information? YES ____ NO ____

18. When appropriate, name or describe instruments? YES ____ NO ____

19. List the intended users of the evaluation information? YES ____ NO ____

20. Indicate when evaluation reports will be presented, and how they will be presented (oral, written, etc.)? YES ____ NO ____

SUMMARY FORMAT FOR EVALUATION DESIGN

There is a simple procedure to summarize an evaluation design without requiring the readers to wade through lengthy paragraphs. If you can make it easier for the readers to follow your plan, your evaluation design will get a better review.

The technique is a simple two-column form illustrated below. In the left-hand column, write a set of evaluation questions. In the right-hand column, describe the intended data sources. This two-column approach provides the reader with a great deal of information in few words. It also serves as a good tool for planning activities while doing an evaluation.

A partial table of questions and intended data sources should look something like the one below.

Evaluation Question	Data Source
1. Are the materials identified, adapted and developed as scheduled?	Oral reports during staff meetings — weekly meetings for first and second month, twice a month meetings thereafter.
2. Are teacher interviews to identify potential units for environmental education progressing as scheduled?	Oral reports during staff meetings — weekly meetings for first and second month, twice a month meetings thereafter.
3. Do teachers find the materials and suggested activities to be adequate and appropriate for their class units?	Teacher questionnaires with each trial use of the set of materials, and selected observations by staff members.
4. What additional changes can be made to improve student knowledge and attitude?	Item analysis of students' answers to unit tests.

The summary format can be expanded to include additional information such as instruments, by whom and when data will be collected, analysis method and reporting method. The examples below uses an extended format of headings contained in an evaluation designed by the Northwest Regional Educational Laboratory.

Summary of Evaluation Design

Program Component and Evaluation Question	Source of Information	Instrument	Data Collection When	Data Collection Who	Analysis	Reporting
A. Materials Development						
1. Are the materials identified, adapted and developed as scheduled?	Staff	Minutes of meetings	Weekly	Project Director	Descriptive	Progress Report
2. Are teacher interviews to identify potential units for environmental education progressing as scheduled?	Staff	Minutes of meetings	Weekly	Project Director	Descriptive	Progress Report
3. Do teachers find the materials and suggested activities to be adequate and appropriate for their class units?	Teachers	Teacher Questionnaire #1 and - Staff observation	After use of each unit. Schedule monthly from January to April	Mrs. White Staff	Frequency distribution Content analysis and frequency distribution	Oral reports during staff meetings. summarized in progress reports.

We can describe the five major steps for conducting evaluations. The number of major steps is arbitrary. As you will see in the next few pages, each step includes several activities.

STEP ONE: DEVELOP AN EVALUATION DESIGN

STEP TWO: SELECT AND/OR DEVELOP INSTRUMENTS

STEP THREE: COLLECT APPROPRIATE DATA

STEP FOUR: ANALYZE THE DATA

STEP FIVE: PREPARE AND PRESENT REPORTS

Don't be misled, the steps are not totally sequential. During the middle of the program year you may be working on some aspects of all five steps. Although most of the planning will come early and the reporting later, you may be planning modifications of some evaluation activities while reporting the results of an earlier evaluation.

STEP ONE - DEVELOP AN EVALUATION DESIGN

Chapter 4 provided background information and described an adequate evaluation design. Because the design is so critical, this first step deserves additional consideration.

Some procedures for designing an evaluation are more suited to particular situations than others. Each program will present unique design opportunities and problems, and the planner must be flexible. If you prepared a proposal, you should have a good head start on the design.

Determine the purpose of the evaluation. This step can be accomplished by reviewing the proposal, talking with staff and administrators, reading the legislation for environmental education and reviewing the needs assessment statement. Once you have completed these reviews and interviews, list the major evaluation questions. They will be questions about when and how the program activities take place, questions about things that may facilitate or inhibit the activity, questions about the extent to which the activities were completed and questions about the extent to which the learners gained in knowledge, skill and attitude. There are likely to be overlaps in the questions. Don't worry about overlap or repetition. They can be eliminated later. Be sure to include both formative and summative evaluation questions.

Determine the data to be collected. Sift through all of the possible evaluation questions and select the ones that are most important. Then list alternative methods for gathering data to answer each question.

For example:

Question — What sections of the instructional materials require modification?

Alternative Data Collection Strategies

1. Item analysis of answers to unit tests.
2. Teacher interviews.
3. Learner interviews.
4. Teacher questionnaires.
5. Learner questionnaires.
6. Classroom observation.

Review the strategies for feasibility and cost, then select the ones you will use. If you are wise you will describe the analysis strategy to be used with each set of data.

NOTE: Part E (p. 49) of the appendix includes a brief review of several kinds of data. Familiarity with several kinds of data is useful in determining the data to be collected. A discussion of summative evaluation designs is also presented in part F (p. 53).

Prepare a time line and cost estimate. Evaluation activities must be administered carefully. It helps to have a detailed time line and budget estimate for a guide. You may have to deviate from your plan; the time line and cost estimates will aid management. A short instructional unit on constructing time lines and cost estimates is included as part A of the appendix (p. 38).

Draft the design and review with key administrators. Once you have completed activities a, b and c, you are prepared to draft the first version of the evaluation design. The plan should contain an introductory paragraph to give the reader an overview of the evaluation strategy, a formative component, a summative component and a work plan. Much of this can be done in summary form.

Present the first draft to key administrators and other persons who intend to use the evaluation results. This procedure will help you determine whether you selected the important questions and whether your plan includes data that is meaningful to key administrators and staff.

Make revisions as indicated by the review.

Describe the evaluation reports. This activity can be part of your evaluation plan but is often overlooked. If you develop a complete time and cost estimate, much of the work for this activity will already be completed. You should specify exactly what reports will be prepared and what kinds of questions will be addressed by each report. Don't forget to include oral reports as well as written reports. Estimate dates for each of the written and oral reports.

Be prepared to modify your evaluation design. A plan is developed to help the management and coordinate a set of complex activities. But a plan has to be flexible. The need for flexible plans is especially important when working with a new area such as environmental education. There are many unforeseen complications that will cause you to deviate from your plan.

One common experience in evaluating environmental education and related educational programs is the month-to-month changes in the program itself. You have to be willing to adapt your evaluation plan as the program changes to meet the unique conditions in the schools and/or community.

Sometimes the goals and objectives for an environmental education program are not specific and detailed. In these cases it is often difficult to ask precise evaluation questions. In fact, the intended results or intended procedures may change several times during a year. You may have to use evaluation strategies that help answer broad questions such as, "what activities are being carried out by the environmental education staff?" and, "what is the apparent result of these activities?" Frequently, motion picture and still photographs can be used to support detailed descriptions of what happens during complex activities such as field trips. The important thing to remember is:

DON'T TRY TO MAKE THE PROGRAM ADJUST TO YOUR EVALUATION DESIGN, BE PREPARED TO ADJUST YOUR EVALUATION PLAN TO MEET THE NEEDS OF THE PROGRAM.

Step One
Develop an Evaluation Design

ACTIVITIES

a. Determine the purpose - talk to key people and review the proposal, law and needs assessment. Then list the formative and summative questions.

b. Determine the data to be collected - select major questions to be answered, list alternative data, review cost and feasibility, then select.

c. Prepare a time line and cost estimate.

d. Write the plan and review with key administrators and staff.

e. Describe oral and written reports.

d. Be prepared to modify your evaluation design.

STEP TWO - SELECT AND/OR DEVELOP INSTRUMENTS

Your evaluation design may have indicated the instruments that will be used to collect data. Most likely you only described instruments that will have to be selected or developed.

After you have identified the information required to answer the important evaluation questions you should begin a detailed search for existing data. Always try to use existing or recorded data before gathering new data. In some cases you will want to use instruments such as tests, attitude scales, observation scales, etc. The sample instruments contained in Volume 2 of this manual should provide some assistance. It may be possible to use one of the instruments or to modify an instrument to meet your requirements.

Part C of the appendix (p. 42) contains a few pointers on instrument construction and modification. The pointers discussed include:

— Don't crowd items on the page.

— Use colored paper with surveys.

— Be concerned with ability to tabulate responses.

— Items should deal with a single concept.

— Avoid bias in the wording of the item.

— Review early drafts with colleagues.

— Pilot test the instruments and proposed data analysis.

— Format considerations.

You may be concerned with the reliability and validity of the data you collect with specific instruments. If you are not familiar with these concepts, a data analyst can help you determine the reliability and validity of your data.

Reliability is concerned with the extent to which the measures obtained at a given time and place are the same as measures that would be obtained from the same individuals at a different time and place. If the individuals who respond to the instrument would get the same scores whether the measurement was taken this morning, this afternoon, or tomorrow morning, etc., the instrument is said to have high reliability. However, if the data are strongly influenced by the time of day, the weather conditions, or other factors not related to the purpose of the measurement, the instrument is said to have low reliability. It is important in evaluation to have data sets that have high reliability.

Validity is concerned with the extent to which the data represent what you want to measure. If you are interested in assessing students' knowledge of environmental education facts, but discover the scores are more influenced by the students' reading abilities than by their knowledge of environmental education, the data have low validity.

A discussion of mathematical techniques used to establish the reliability and validity can be extremely complex and far exceed the limits of this manual. However, these concerns are not trivial and should be seriously considered.

Don't forget to pilot test the instruments. Remember, evaluators who neglect to pilot their instruments usually end up with some USELESS DATA. (For additional information, see appendix C, p. 42.)

Step Two
Select and/or Develop Instruments

ACTIVITIES

a. Search for existing data.

b. Review existing instruments.

c. If needed, modify existing or construct new instruments.

d. Pilot instruments and proposed data analysis.

e. Consider reliability and validity.

STEP THREE - COLLECT APPROPRIATE DATA

Evaluators must always remember that collecting data in the form of tests, questionnaires, interviews and observations, is an intrusion on people's time and privacy. People are doing you a favor by providing information for evaluation. It's no more pleasant for a teacher or administrator to be surprised by the data collection procedure than it is to be surprised by out-of-town breakfast guests early Saturday morning.

An evaluator must be prepared to devote a significant amount of time to setting up schedules for collecting data. When you establish a schedule for data collection, always make sure that the people you will be working with know what to expect. Occasionally it may be impossible for someone to keep their part of the schedule. If this happens, don't be angry and demand they comply. Thank them for their time and make an effort to reschedule.

Make sure you always keep your part of the schedule. If you must miss a scheduled appointment, be sure to inform the individuals involved and give plenty of advance notice.

There are a variety of ways to collect data. Many of these are described in part E of the appendix (p. 49). Try to use those strategies that least interfere with ongoing environmental education programs. **ABOVE ALL** — be consistent in instructions and methods. Variation in your instructions or methods can affect the data. It is a good idea to read directions from a prepared "set of instructions."

Step Three
Collect Appropriate Information

ACTIVITIES

a. Set up appointments.

b. Inform people of what to expect.

c. Willingly reschedule, if requested by respondents.

d. Give advance notice if you must delay data collection.

e. Use a consistent set of instructions and methods for data collection.

STEP FOUR - ANALYZE THE DATA

Analysis includes aggregation of data and interpretation of findings. Parts D and E of the appendix (p. 45 and p. 49) provide several suggestions for data analysis. We have avoided complex examples of the statistical analyses. However, it will sometimes be necessary to use sophisticated analysis techniques. There are a large number of education statistics texts that give step-by-step assistance in using specific data analysis strategies. If you are not familiar with the techniques, it is probably better to obtain the assistance of a data analysis specialist rather than to try to learn statistics while you are doing your first evaluation. Many data analysis specialists will be glad to teach you to use specific data analysis techniques as they are providing consultant assistance.

You will want to use a consultant who will analyze the information **with** you rather than one who will analyze the information **for** you. Make sure you understand the analysis so you can interpret the result. Don't expect a data analysis specialist to interpret the data - (s)he doesn't know the details of your environmental education program.

Step Four
Analyze the Data

ACTIVITIES

a. Plan and pilot analysis before collecting real data.

b. Aggregate or prepare data.

c. Conduct statistical analysis as appropriate.

d. Use a data analysis consultant when/if needed.

e. Interpret the result of the analysis.

STEP FIVE - PREPARE AND PRESENT REPORTS

Evaluation reports are more useful if they contain recommendations and interpretations of data. Don't just present data. Tell people what message the data contains.

Written evaluation reports are only one kind of report. It is important that oral reports be given at various times throughout the development of the program. This is especially true with formative evaluation.

One of the problems with formal written evaluation reports is time. Frequently key project staff and agency administrators are required to make critical decisions before the written reports are ready. It will often be necessary to provide an oral review of the critical aspects of the data prior to writing the final report.

Because formative evaluation is intended for utilization by the program staff, oral evaluation reports are often used. When you make an oral presentation you should use a small amount of documentation and written summaries to support your presentation.

Final program evaluation reports should be developed in several forms. They should always be accompanied by a one or two page executive summary. Administrators will frequently make decisions based on the executive summaries and delay examining the full report until a later date.

Step Five
Prepare and Present Reports

ACTIVITIES

a. Concentrate on the message of the analysis - prepare recommendations.

b. Prepare short summaries of each report.

c. Use alternative forms of reports, oral and written.

OUTLINE OF EVALUATION STEPS AND ACTIVITIES

Step One - Develop an evaluation design

a. Determine the purpose.

b. Determine the data to be collected.

c. Prepare time line and cost estimate.

d. Write the plan and review with key administrators and staff.

e. Describe oral and written reports.

f. Be prepared to modify your evaluation design.

Step Two - Select and/or develop instruments

a. Search for existing data.

b. Review existing instruments.

c. If needed, modify existing or construct new instruments.

d. Pilot instrument and proposed data analysis.

e. Consider reliability and validity.

Step Three - Collect appropriate data

a. Set up appointments.

b. Inform people of what to expect.

c. Willingly reschedule, if requested by respondents.

d. Give advance notice if you must delay data collection.

e. Use a consistent set of instructions and methods for data collection.

Step Four - Analyze the data

a. Plan and pilot analysis before collecting real data.

b. Aggregate or prepare data.

c. Conduct statistical analysis as appropriate.

d. Use a data analysis consultant when/if needed.

e. Interpret the result of the analysis.

Step Five - Prepare and present reports

a. Concentrate on the message of the analysis - prepare recommendations.

b. Prepare short summaries of each report.

c. Use alternative forms of reports, oral and written.

FINDING HELP

Perhaps the best method of locating help with needs assessment and program evaluation is to contact the evaluation office of your state department of education. They usually have a file on consultants and can help you find the right person.

EVALUATION STANDARDS

Persons responsible for evaluating environmental education and other educational programs are often concerned with the worth of their evaluation. It's very difficult to answer individuals who want to know if they have done a good job. To assist the assessment of educational evaluation efforts, a large group of educational evaluators was convened to develop a set of standards. This group of specialists,

called the Joint Committee for Standards on Educational Evaluation, published a draft of the **Standards for Evaluation of Educational Programs, Projects, and Materials:** November, 1978. This 140-page manual contains a description of 29 standards that can be used to assess the quality of an educational evaluation effort. An environmental educator seriously interested in educational evaluation could benefit from reviewing a copy of this draft. Copies of the standards can be requested from Dr. Daniel L. Stufflebeam, Educational Evaluation Center, Western Michigan University, Kalamazoo, Michigan 49008.

The appendix contains a series of short lessons on special topics. The special topics are:

A. Cost and time estimation

B. Selecting a random sample

C. Instrument construction and modification

D. Data Analysis

E. Kinds of data and related analysis

F. Summative evaluation designs

A. COST AND TIME ESTIMATION

Cost and time estimation is a required activity for people who plan, manage, and direct needs assessments, evaluations and environmental education programs. Estimation involves guesswork. The more you know about the work being planned, the more accurate your guesses.

Time and cost estimation includes the preparation of a **work breakdown structure.** This requires a list of activities and tasks required to complete each major step of the study.

To prepare a work breakdown structure:

List the people who will work with the activities and indicate when they will be available.

List the tasks that must be completed. Tasks are more specific than activities; be as specific as possible.

Assign tasks to specific people. Estimate the time required and note special costs.

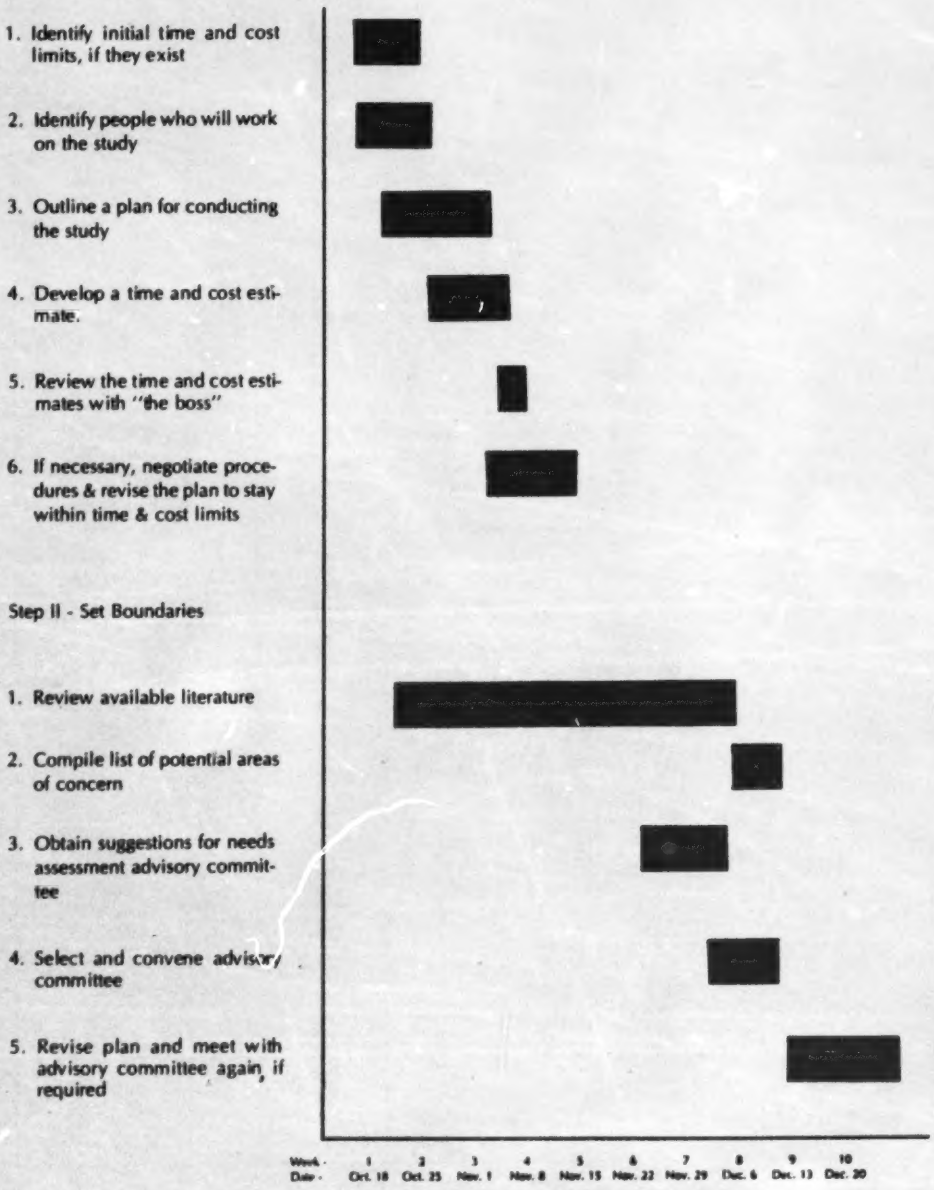
Your work breakdown structure should look something like Figure A-1.

Figure A-1. Work breakdown structure for needs assessment study.

Major Steps	Activities	Task	Person/Time			Special Cost
			Mary	Bill	Secretary	
1. Establish time and cost limits						
2. Set the boundaries	1. Review the literature	a. Obtain ok for ERIC search	1 hr	—	—	$30 for ERIC search
		b. Select key words	1 hr	2 hrs	—	
		c. Submit request for ERIC search to library	—	—	1 hr	
		d. Review abstracts	—	1 day	—	
		e. Check out copies of microfiche from library	—	2 hrs	—	$3 travel to university library
		f. Read and take notes from microfiche	—	3 days	—	$10 rent for microfiche
		g. Review card catalogue and education index in library	½ day	—	—	$3 travel to university library
		h. Identify and obtain books and journal articles	½ day	—	—	$10 for 200 pages at 5c per page of copies from restricted journals
		i. Read and take notes from books and journal articles	3 days	—	—	
		j. Obtain copies of local newspaper articles	—	½ day	—	$10 for search of newspaper files

		k. Read and take notes from newspaper articles	—	½ day	—	$3 travel to university library
	2. Compile list of potential concerns	a. Generate categories of concerns	3 hrs	3 hrs	—	
		b. Organize notes by category of concern	½ day	½ day	—	
		c. Produce list of concerns in each category	—	—	½ day	
		d. Schedule group meeting and/or individual meetings to review tentative list of concerns with Bill Ellen, Maude Quillian, Ralph Shipley and Joe Walker	—	—	2 hrs	
		e. Mail list to reviewers	½ hr	—	—	$1 postage
		f. Meet with individuals or small groups to review concerns	½ day	½ day	—	
		g. Make changes to list concerns	2 hrs	2 hrs	2 hrs	
		h. Send revised list and thank you letter to each of the reviewers	1 hr	—	1 hr	$1 postage
	3. Obtain suggestions for advisory committee					

Figure A-2. Gantt chart (timeline) for needs assessment study.


Activities
Step I - Establish Time and Cost Limits
1. Identify initial time and cost limits, if they exist
2. Identify people who will work on the study
3. Outline a plan for conducting the study
4. Develop a time and cost estimate.
5. Review the time and cost estimates with "the boss"
6. If necessary, negotiate procedures & revise the plan to stay within time & cost limits
Step II - Set Boundaries
1. Review available literature
2. Compile list of potential areas of concern
3. Obtain suggestions for needs assessment advisory committee
4. Select and convene advisory committee
5. Revise plan and meet with advisory committee again, if required
Week - 1 2 3 4 5 6 7 8 9 10
Date - Oct. 18 Oct. 25 Nov. 1 Nov. 8 Nov. 15 Nov. 22 Nov. 29 Dec. 6 Dec. 13 Dec. 20

The following references describe more sophisticated methods of time and cost estimations:

Cook, Desmond. **Educational Project Management.** Charles E. Merrill Company, 1971.

Cook, Desmond. **PERT: Applications in Education.** U. S. Department of H.E.W., Office of Education, 1966. (Superintendent of Documents Catalog No. FS 5.212:12024).

Kaufman, Roger. **Educational Systems Planning.** Prentice-Hall, Inc., 1972.

VanDusseldorf, Richardson and Foley. "Chapter 8, PERT and CPM." **Educational Decision Making through Operations Research.** Allyn and Bacon, Inc., 1971.

Simons, Howard. "PERT: How to Meet a Deadline." **Educational Administration: Selected Readings.** Walter Hark (Ed.). Allyn and Bacon, Inc., 1965.

B. SELECTING A RANDOM SAMPLE

The easiest way to select a random sample is to let a computer do the work for you. Many computer centers have existing computer programs that will generate a random sample. All you need to know is the number of individuals on your list and the size of the sample you want.

But if you don't have access to a computer you can still select the random sample yourself. The procedure is simple. In addition to the list of people in the group you wish to sample, you need a random number table available in books of tables and statistical texts. The following outline explains the procedures.

STEP ONE: You start with a list of people in the group you wish to sample. The list should not be in any special order on characteristics that could affect the survey. Lists based on previous test scores or previous response patterns are undesirable. Lists in alphabetical order or by address are most common and acceptable. Rearrange the list if necessary.

STEP TWO: Assign the number 1 to the first item on the list and continue to assign consecutive numbers to each individual on the list.

STEP THREE: Decide how many digits you will need. If there are 59, 43, 88 or 27 individuals on your list, you will need two digits. If there are 129, 791, 327 or 912 individuals on your list, you will need three digits. And so on.

STEP FOUR: Pick any spot on the random number table to start. Place a ruler over the digits to the right, so that only the necessary digits are exposed.

STEP FIVE: Read the first number in your sample and continue down the column then up and down subsequent columns until you have selected the individuals for your sample. Ignore numbers that show up a second or more times.

Selecting a random sample gives each item in the group an equal chance of being chosen. Random sampling substantially reduces the possibility that a biased or unrepresentative sample will be selected.

The following example of a sampling problem uses the miniature random number table in Figure 3.

EXAMPLE

Suppose we want to sample 25% (15) of the individuals from a group of 59 people. First, we would number the individuals on our list from 1 to 59. We need two digits from the random number table. Pick any spot on the random number table to start (circled) and place a ruler over the digits to the right so that only the necessary digits are exposed. We leave the 1 and 2 uncovered while the 7, 6 and 5 are covered by the ruler. The first item in our sample will be 12. Subsequent individuals will be 21, 27 and 53. 96 and 91 are not items on the group, so we ignore them and move on to 58 and 32. 27 has already been selected, so we ignore it and move on. 33, 01, 25, 22, 06. We ignore 81 and move on. 11, 56, 05. We ignore 63,53 and 88 and move on. 48. We have now selected the 15 individuals for our sample.

12, 21, 27, 53, 58, 32, 33, 01, 25, 22, 06, 11, 56, 05, 48

Figure 3. Random number table

Column	1	2	3	. . . . .
Line				
1	10480	15011	01536	. . . . .
2	22368	46573	25595	
3	24130	48360	22527	
4	42167	93093	06243	
5	37570	39975	81837	
6	77921	06907	11008	
7	99562	72905	56420	
8	96301	91977	05463	
9	89579	14342	63661	
10	85475	36857	53362	
11	28918	69578	88231	
12	63553	40961	48235	
13	09429	93969	52636	
14	10365	97336	87529	
15	07119	61129	71048	
16	51085	12765	51821	
17	02368	21382	52404	
18	01011	27092	33362	
19	52162	53916	46369	
20	07056	96728	33787	
21	48663	91245	85828	
22	54164	58492	22421	
23	32639	32363	00597	
24	29334	27001	87637	
25	02488	33062	28834	. . . . .

C. INSTRUMENT CONSTRUCTION AND MODIFICATION

The scope of this appendix does not merit a comprehensive review of instrument design. The best advice we can give is to find an existing instrument that comes close to what you want and then make modifications to fit your needs. (Sample instruments in Volume 2 of this manual should provide some useful examples)

Whether you modify an existing instrument or design a new instrument, there are a few basic principles to keep in mind. Let's discuss the more simple points first.

BASIC PRINCIPLES

Principle 1: Don't crowd the items on the page. It is usually better to have more pages with well spaced items (a good deal of "white" space around the items) than to have a small number of pages that are crowded. Extremely small printing is also bad. Small printing and tightly packed instruments tend to tire people and create antagonism.

Principle 2: Use colored paper with surveys. Mail surveys will frequently receive a greater percentage of returns when put on colored paper. It is generally advisable to use a warm color such as beige or light green and to avoid the harsher bright colors such as bright pink.

Principle 3: Be concerned about response tabulation. Rating scales, multiple choice questions, true-false questions and similar "closed response" items are easy to tabulate. Design items so that each respondent checks just one alternative per question. Avoid questions that ask the respondent to "check all of the appropriate responses." Open-ended questions or questions that require writing a phrase or paragraph are very difficult to tabulate. Attempts to tabulate such responses often result in long lists of all of the answers. This kind of listing is seldom useful and has little if any meaning to people who want to use the information from the study.

It is very common for researchers to **abandon** the attempt to tabulate and interpret open-ended

questionnaires. True, open-ended items appear to have the benefits of obtaining more in-depth responses and avoiding overstructure. But if you want in-depth data, it is better to use an interview technique and to obtain information from a smaller number of people.

One of the major problems with open-ended responses is the wide variety of detail in responses. Some responses will be extremely specific and refined. Other responses will be very broad and general. This fact makes tabulation almost impossible.

Principle 4: Items should deal with a single concept. Whenever an individual item contains two major concepts, the respondent finds it difficult to answer. For example, if you ask the respondent the importance of "field" trips and "guest presentations," some people won't know how to respond. They may believe field trips to be very important but guest presentations to be less important. These are called **double loaded** questions.

The principles listed above are very important but are relatively easy to deal with on your own. A little practice in constructing instruments will build your skill. There is an additional set of pointers that is **EXTREMELY IMPORTANT.**

Principle 5: Avoid bias in the wording of the item. People committed to and interested in environmental education frequently are not sensitive to bias in the wording of questions. A bias is caused when wording tends to "force" respondents to answer in a specific way. Some examples of questions with wording bias are:

Wouldn't you agree that energy conservation should be taught in the schools?

Should students be taught to employ good conservation practices and be shown how to avoid bad or energy wasting habits?

How important is it that students learn about modern game management techniques as opposed to out-of-date practices?

Each of these examples contain loaded words and value orientations that tend to direct the answers.

Principal 6: Ask a group of your colleagues to review the instruments. Once you have the instrument in draft form ask a group of "neutral" colleagues to review your instrument. They should be looking for (a) clarity of directions, (b) appropriateness of the material, (c) readability and appropriateness for the age level and group of intended respondents, (d) item bias, and (e) double loaded questions.

Principle 7: Pilot test the instrument. Instruments should always be pilot tested with a small sample of individuals similar to those who will respond to the instrument. Try to avoid using your secretary, husband, wife and neighbors unless these individuals truly represent the people who will respond to the test or questionnaire. When you pilot the instrument it is a good idea to use the "tutorial" technique with at least part of the sample.

To use the tutorial technique you should place one or two respondents on one side of the table while you sit on the other side and observe their response patterns. When you notice hesitation or other body language indicating a problem, interrupt and ask what is bothering them. This procedure will identify problems and concerns with the instrument. In many cases your respondents can provide specific solutions that will improve the instrument.

A pilot test of the instrument almost always identifies major flaws that otherwise "slip through." In the majority of cases, failure to identify and correct these flaws will produce bad information that leads you with confidence in the wrong direction.

The pilot test will also produce data that can be used for checking the appropriateness of your planned data analysis technique.

VALIDITY AND RELIABILITY

Don't forget to look at the reliability and validity of your data.

Validity concerns the extent to which the measure tells you what you want to know as opposed to being influenced by a different factor. For example, if you have a test on knowledge of environmental education facts, but some people score low because the test had the wrong reading level, the test is not valid. It is more affected by the factor of reading ability than the environmental education knowledge. You wanted to measure environmental education knowledge, but you actually measured reading ability.

Reliability is concerned with the extent to which the measures obtained at a given time and place are the same as measures that would be obtained from the same individuals at a different time or place. This is sometimes called "reproducibility." If the time of day, conditions of the facilities or other events cause you to get results that are different from those received under "normal" conditions, you have an unreliable measure.

These are complex topics and involve sophisticated statistical procedures. If you have that background, you should use it to explore the reliability and validity of your instruments. However, don't let these concerns be a roadblock to your attempt to gather the information required for your study.

Educators seldom, if ever, have good validity information about their instruments. If you carefully follow the procedures we have described you will be in pretty good shape. You can obtain a "feel" for validity by comparing responses from different groups of people or different kinds of information dealing with the same topic. If they agree, you probably have valid information.

Depending upon the kind of instrument you use, it is sometimes fairly easy to determine the instrument reliability. However, there are many different kinds of reliability calculations. With some kinds of instrumentation you can't determine reliability without using highly sophisticated techniques.

FORMAT CONSIDERATIONS

When you design a question that has a set of alternative answers, it is best to provide a set of boxes, brackets, or parentheses for each alternative answer (see Figures A-4 and A-5). Try to avoid using open blanks. When you use an open blank, the respondents will sometimes make a large mark so that you can't determine the intended response.

Use a constant format. Many different response formats will confuse the respondents (see Figure A-5). If you must use more than one response style, try to group the items together so that you will have sections of similar response formats.

The order in which questions are placed on the instrument can affect responses. It is best to group related items together. However, you will want to randomly arrange items within each topic group. For example, if you have six questions dealing with population dynamics (questions 11 through 16) they should stay grouped together, but you may want to randomly assign the order of the six items.

Figure A-4. Sample item

6. Has any member of your family visited the Foothills Environmental Center?
   [ ] Yes
   [ ] No
   [ ] Don't know

Figure A-5. A sample instrument with too many formats

1. What is your age? _____

2. How many persons live in your house?
   [ ] 1 or 2 [ ] 3 or 4
   [ ] 5 or 6 [ ] 7 or more

3. Circle the number to indicate the extent to which you agree with each of the following statements.

	Disagree				Agree
(a) Pollution is caused by "big" cars	1	2	3	4	5
(b) Pesticides are over used	1	2	3	4	5

4. Are any of the following on the endangered species list?

(a) The Grizzly Bear ☐ Yes ☐ No ☐ Don't know

(b) The American Wolf ☐ Yes ☐ No ☐ Don't know

There are a large number of materials on instrument construction. In addition to some of the more commonly used textbooks in courses on introduction to research you may find the following helpful.

Babbie, Earl R. **Survey Research Methods.** Wadsworth Publishing Company, 1973.

Schechter, P.S., and O'Farrell, T.M. **Training and Continuing Education.** Hospital Research and Education Trust, Chicago, Illinois, 1970.

Survey Research Center. **Interviewers' Manual: Revised Edition.** Survey Research Center, Ann Arbor, Michigan, 1978.

TenBrink, Terry D. **Evaluation: A Practical Guide for Teachers.** McGraw-Hill Book Company, New York, 1974.

D. AVERAGES AND SPECIAL ANALYSIS METHODS FOR SOME NEEDS ASSESSMENTS

The analysis for most studies is simple. It can consist of summaries of the number and percentage of respondents who correctly answered test items, the number and percentage of respondents who checked each alternative on rating scales, etc.

HOW TO CALCULATE AVERAGES

On occasion, you will want to calculate averages. The easiest kind of average is the mean — sum the values for each response and divide by the total number of responses.

For example, if from 86 responses to a 5-point rating scale the ratings for item number eight were:

0 ratings of 1 =	0 points
12 ratings of 2 =	24 points
36 ratings of 3 =	108 points
31 ratings of 4 =	124 points
7 ratings of 5 =	35 points
86 responses	291 points

The mean equals 291 divided by 86, or 3.38.

Frequently a different kind of average is used — the median. It is a better kind of average to use with rating data but is harder to calculate. If you don't have access to a computer or don't already know how to calculate an exact median, you should use the mean as the average.

Don't be fooled! Calculating averages can be more complex than you think. Look at the next section.

HOW TO CALCULATE THE OVERALL AVERAGE

Some studies collect ratings from several different groups of respondents: teachers, students, parents, administrators, etc. The average ratings is calculated for each group. However, an **overall** average is desired. How is it done?

There is no simple answer! It depends on what you intend to do.

If we use **means** and intend each **group** to have an equal weight, we can add the group means and divide by the total number of groups. For example:

Group Name	No. of People in Each Group	Group Mean
Teachers	50	2.60
Students	100	4.50
Parents	200	3.35
Administrators	10	1.10
Total		11.55

The overall average of the four group means is 11.55 divided by 4, or 2.81.

When we use this method of getting the overall average, each **group's** opinion is counted equally, but every **person's** rating is **not given** the same weight. In the example, an administrator's rating is counted five times as much as a teacher's, ten times as much as a student's and 20 times as much as a parent's. A teacher's rating is counted twice as much as a student's and four times as much as a parent's. These different weights are due to the different number of people in each of the groups.

If we wanted each person's rating to count the same regardless of the group they represent, we would have to go back to the original ratings. The overall average would be calculated by adding all of the ratings to form a grand total. Then divide the grand total by the number of raters. In this example, the overall average would be 1,261 divided by 360, or 3.50. (130 for teachers + 450 for students + 670 for parents + 11 for administrators = 1,261.)

You can see the difference in the two overall average values; 2.81 vs. 3.50.

We can also calculate an overall average so that each person's rating is given a specific relative weight. For example, if we want the relative weights given to persons in a particular group to be:

Weight	Group
1	Students
3	Parents
5	Teachers
10	Administrators

then we can proceed as follows:

Group	No. of People in Each Group	Weight	Total of all Ratings Within Each Group	Weight Times Total of Group Ratings	Weight Times Number in Each Group
Students	100	1	450	450	100
Parents	200	3	670	2,010	600
Teachers	50	5	130	650	250
Administrators	10	10	11	110	100
Totals				3,220	1,050

The overall average is then calculated by dividing the two totals. The overall average would be 3,220 divided by 1,050, or 3.07.

As you can see, this new overall average is different from the others. To calculate the third overall average, we determined the relative weight of each person's rating. This is **not** the relative weight of each **group.** We can see the group's relative weight by looking at the column headed Weight Times Number in Each Group. This shows that students (as a group) and administrators (as a group) were counted equally. The parents (as a group) counted six times as much as the students and administrators. The teachers (as a group) counted two and one-half times as much as the students and administrators.

These three different ways of calculating an overall average are important. Only you can decide which method to use. There is no "most correct method."

CALCULATING DEFICIENCIES FROM PERCEIVED NEEDS RATNGS

Some models of needs assessment suggest the use of two ratings for each item on the needs assessment survey. A rater is asked to respond to "what should be" and "what is." The deficiencies are obtained by subtracting the two averages.

Educators are frequently dissatisfied with these results. Dissatisfaction comes from two factors:

1. The two scales are sometimes different.

2. A difference between them cannot be calculated.

For example, respondents might be asked to rate the importance of field trips on a 5-point scale.

How important are field trips?

1 2 3 4 5
Low High

They are then asked to indicate the number of times students go on field trips each year.

How often do students go on field trips each year?

0 1 2 3 4 5 6 7 8 9 or more

In this case, we can't subtract averages of the two items. The scales and questions are different. Even if the ratings of the number of field trips was from 1 to 5, it would make no sense to subtract the two averages.

In other cases, respondents are asked to rate "what should be" and "what is" in comparable forms. For example:

Curriculum Content	Extent to Which This Topic "Should Be" Taught	Extent to Which This Topic "Is Being" Taught
1. Air Pollution	1 2 3 4 5	1 2 3 4 5
2. Population Dynamics	1 2 3 4 5	1 2 3 4 5
3. Forest Resources	1 2 3 4 5	1 2 3 4 5

If two averages are calculated for each item, you can subtract one from the other. However, the set of differences may have little meaning. No one knows what it means to have a difference of 1.05 between an average rating of the extent to which a topic "should be taught" and the extent to which the topic "is being taught."

Don't make the mistake of thinking that a difference of 1.05 for "air pollution" and a difference of 1.35 for "forest resources" indicates there is a greater need for curriculum on "forest resources." It may be more important to reduce the small deficiency for "air pollution" than to reduce the larger deficiency for "forest resources."

One interesting analysis strategy has been used with some of the double rating needs assessment models. This analysis is illustrated below.

Rate the "importance" of each item and the extent to which the topic "is being taught."

Curriculum Content	Importance	Extent to Which This Topic Is Being Taught
1. Air Pollution	1 2 3 4 5 6 7	1 2 3 4 5 6 7
	Low High	Low High
2. Population Dynamics	1 2 3 4 5 6 7	1 2 3 4 5 6 7
	Low High	Low High
3. Forest Resources	1 2 3 4 5 6 7	1 2 3 4 5 6 7
	Low High	Low High

The data are collected and the averages calculated for each item. The average values obtained for each item under the "importance" heading were 4.3, 5.1 and 2.1. The average values obtained for each item under the "is being taught" heading were 2.1, 5.0 and 3.3. The means of the values in the two columns of average responses were 3.8 and 3.5.

Curriculum Content	Average Rating of "Importance"	Average Rating of "Extent to Which this Topic is being Taught"
1. Air Pollution	4.3	2.1
2. Population Dynamics	5.1	5.0
3. Forest Resources	2.1	3.3
Column Average	3.8	3.5

A chart is then formed by crossing two scales at the average of the two columns. The pair of averages for each item is used to plot the item on the chart. The three items just illustrated are plotted on Figure A-6.

By crossing the two scales four sections are formed. The items falling in section two are called high needs and the items falling in section three are called low needs. The items falling in the other sections indicate no need. The four sections are identified in Figure 6.

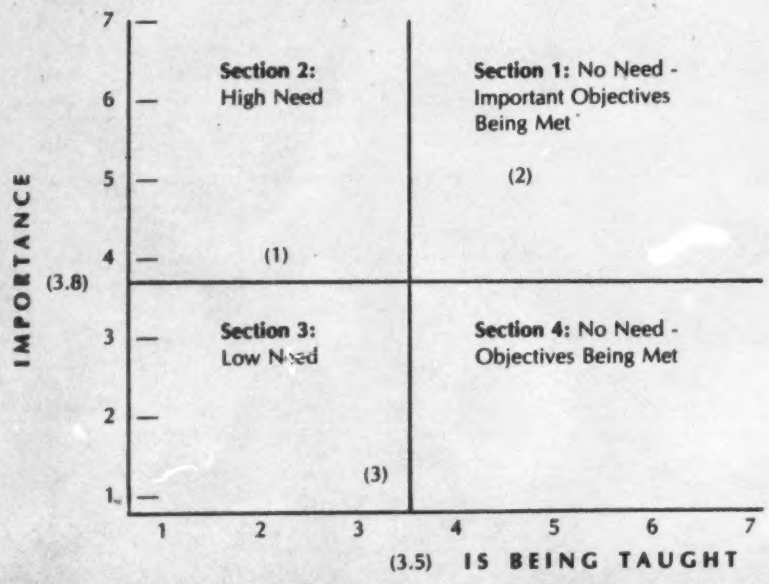
Taylor (1979) used a variation of this procedure to identify inservice training needs. His intention was to identify the inservice training needs of 20 specialized staff members. He provided a list of job skills and asked each person to rate the importance of each skill to their job and to rate the current level of their skill. A wide range of responses was obtained on each item. Thus an average response for each item would not adequately represent the "importance" or "current skill" of a specific respondent. Use of the averages would have led to the identification of "training needs" that were artificial needs.

To resolve the problem, Taylor constructed a four section chart for each of the 20 respondents. Each person's average response for "importance" and average response for "current skill" were calculated and used to form a unique four section chart for each person. The pair of ratings for each item was used to place the item into one of the four sections (high need, low level need, or no need).

This process was used to identify the self-perceived training needs of each individual. The number of people having a "high need" for training in each skill area was tabulated. This information was used to plan an inservice program to match the self-perceived needs of the group.

NOTE: Be careful to make sure you select the correct section for High Need. It will depend on how you ask the question.

Figure A-6. Plot of Item Average Ratings



E. KINDS OF DATA AND RELATED ANALYSIS

Listed below are six categories of data you might consider. There's nothing magic about the six categories. They were selected for ease of discussion. The category system is nothing more than a convenience.

CATEGORY 1 - DOCUMENTS AND RECORDS

Documents and records can be used as part of the data for both needs assessment and evaluation. A great deal of formative evaluation and a portion of the summative evaluation will rely on detailed records and documentation of what happens during the program/project. Sources include:

Detailed records of management functions such as staff hiring

Minutes of staff meetings

Records of materials purchased

Lists of persons attending conferences or general meetings

Counts of number of parents, community members or students attending workshops

Descriptions of presentations

Records of field trips

Curriculum outlines and guides

You should be able to list other examples of record data.

Data Analysis. You may want to convert some record data percentages, e.g., percent of participation or percent of increase in attendance at workshops and/or presentations. Also, you can use content analysis (see p. 50) with most records and documents.

CATEGORY 2 - QUESTIONNAIRES

The category "questionnaires" includes larger questionnaires sent to parents or community members, and shorter reaction forms completed by students, teachers and persons attending workshops or presentations.

The items on a questionnaire are often called "open-ended" or "close-ended."

Open-ended items ask a question that must be answered with a phrase, sentence or paragraph response.

Closed-ended items require the respondent to check one of an alternative set of responses. Examples of closed-ended items include:

(a) checking the category "male" or "female" in response to the question "sex."

(b) checking one category "very good," "poor," or "very poor" in response to a question on the quality of a short movie on automobile emissions.

Data Analysis for Closed-Ended Items. The analyses used for closed items include:

(a) frequency distributions

(b) percentages

(c) cross tabulations

Figures A-7 and A-8 represent a frequency and percent distribution and a cross tabulation of the same information.

Figure A-7. Frequency and Percent Distribution

Quality Ratings	Frequency	Percent
Very good	18	50%
Good	12	33%
Neutral	3	8%
Poor	2	6%
Very poor	1	3%
Total	36	100%

Table 17

Frequency and Percent of Quality Ratings of Film on Auto Emissions

Figure A-8. Cross Tabulation

	Males		Females		Total	
Quality Rating	Frequency	Percent	Frequency	Percent	Frequency	Percent
Very good	12	67%	6	33%	18	50%
Good	3	17%	9	50%	12	33%
Neutral	1	5%	2	11%	3	8%
Poor	2	11%	0	0	2	6%
Very poor	0	0	1	6%	1	3%
Total	18	100%	18	100%	36	100%

Table 18

Cross Tabulation of Sex by Quality Ratings of Film on Auto Emissions

Data Analysis for Open-Ended Items. Evaluators have sometimes tabulated open-ended items by providing a long list of all of the answers given by respondents. This type of analysis is very poor and not very useful. An appropriate analysis procedure is called content analysis. In order to use content analysis you must develop a series of categories of responses. These categories can be developed before you send out the questionnaire or after you have examined all of the individual responses. It's probably easier to develop the categories after you've received the responses and have read them at least one time. Once you have developed the category system, have each response read independently by two or more individuals. Each individual assigns the comments to one of the categories. If the responses are long and detailed, the readers may be asked to identify which of the categories were mentioned in the answer. Check to make sure the readers agree on the categories assigned to each answer. If they don't agree, get more readers or provide better training for your readers.

CATEGORY 3 - INTERVIEWS

There are two common types of interviews, the **personal interview** and the **telephone interview.** Both of these kinds of interviews are used to ask questions about:

Behavior — questions about recreations habits, spending patterns, practices used in the home and other actions in areas of human living.

Attitudes — opinions or expectations related to topics such as wildlife conservation, development of alternate energy sources and proposed solutions to environmental pollution.

Personal Demographic Facts — sex, age, occupation, ownership of energy consuming devices and so forth.

Interviews have an advantage over questionnaires because the person doing the interviewing can get detailed and exact answers from the respondent. This is done by repeating the answers recorded on

the interview form as a check on whether the respondent really meant to say what was said, and to provide respondents an opportunity to clarify their intent. It is also possible to get more detailed information by probing. An example of a set of probing questions is given below.

The primary question was: Considering the city as a whole, do you think we have good quality of air, bad quality or what?

The first answer was: "Yes, I do."
(What does the respondent mean? "Yes, we have good air quality" and "Yes, we have bad air quality." Both are possible interpretations.)

Possible probe: "Let me make sure I understand you. Do you think we have good air quality, or bad air quality or what? You said, "Yes, I do" (pause, wait for response). If no response, say "What do you mean?"

Second answer: "I hope we will have good air quality."
(This answer is irrelevant. The question asked what the respondent thought about the current existing air quality, not what the respondent wished or hoped were true.)

Possible further probe: "We all hope we will have good air, but what do you think we have now? Let me just read this question again —" Then repeat original question.

Third answer: "Well, it's hard to tell, but I guess I'd have to say the air quality is very good."

The process of developing a good interview guide for personal or telephone interviews is not a simple overnight task. It takes as much work, if not more work, than developing a good questionnaire. If you intend to use a lot of interviews, you should consider obtaining a copy of **Interviewers' Manual: Revised Edition,** Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, Michigan 48106.

Data Analysis. The analysis of interview data is handled in much the same way as the data for questionnaires. Use frequency and percent distributions and cross tabulations. Sometimes interview guides are constructed in such a way that they are similar to closed-ended questionnaires and the tabulations can be done fairly quickly. In other cases, interviews are constructed more like open-ended questionnaire items, and require content analysis before tabulation can be completed.

CATEGORY 4 - TESTS

Educators are familiar with a variety of tests. Although most tests are paper and pencil tests, we should also consider performance tests. A **performance test** is the measurement of the extent to which a certain skill and/or psychomotor activity can be demonstrated by a given individual.

In most paper and pencil tests each question has a correct answer. In performance tests, rather than a correct answer, you will use a description of the extent to which a task is completed in a given period of time. You may describe the quality or nature of the product produced under a given set of conditions.

There is a lot to know about constructing a test, more than we can possibly discuss in this small space. A short set of pointers on the construction and modification of instruments is included as part C of this appendix (p. 42). These suggestions can be helpful whether you are considering modifying an existing test or constructing a new one. There are also a number of textbooks on educational testing. Any of of these should contain some additional suggestions. A textbook entitled **Evaluation: A Practical Guide for Teachers** by Harry D. TenBrink has a chapter called, "Constructing Teacher-Made Tests." This chapter has some very good ideas that might be useful for less experienced developers.

Data Analysis. There are two major types of data analysis that are used with test data. The first, **item analysis,** is very useful in formative evaluation. When using item analysis to review test data, the evaluator is concerned with all of the responses to each item and not just the total score for each student. In general, an item analysis is conducted by tabulating the frequency and percentage of each potential response to a given question. This information is used to determine where the instructional program might have gone wrong and what aspects of the program need to be changed or modified.

For summative purposes, the analysis of tests usually is based on the total test score for each individual. Frequency and percent distributions of test scores are used. You can also calculate averages and more complex statistics. Part D of the appendix (p. 45), contains a short section on calculating averages.

Environmental education seldom is based on test scores that have national or regional norms. However, if you use a test that does have national or regional norms, you may report percentile or grade level data. Be careful in using percentiles and grade levels in reports. These scores are often misunderstood and can give a wrong impression. You will probably be better off to avoid using this kind of information. However, if it does seem to be appropriate, make sure you are well trained in its use and interpretation.

CATEGORY 5 - OBSERVATION

Observation data can be gathered by systematic observation or by informal observation.

Systematic observation includes those observations made by using a detailed checklist or through recordings made by a trained observer who has memorized selected categories of behavior. The detailed checklist or the set of memorized categories is called the **observation schedule.** A large number of observation schedules have been developed for specific kinds of observation. Some of these may be modified to meet your data requirements. The most complete description of observation schedules is a compendium entitled **Mirrors of Behavior,** developed by Anita Simons and available from **Research for Better Schools,** an Educational Research and Development Center located in Philadelphia, Pennsylvania.

The use of systematic observation requires a great deal of training, and is not practical unless you have a well funded project.

Informal observation can include visits to classrooms, community workshops, field trips, etc. The observer makes short notes during the observation and then converts the notes to descriptive reports or summary judgments at a later time (the sooner the better). In some cases (especially in school classrooms) it is best to avoid taking notes during the observation - it scares people. The observer should write summary statements of what was observed immediately after the observation period.

When you observe classrooms, it is best to make several visits to each classroom. Because observation is not a common event in most classrooms you may not see the typical classroom picture until the third or fourth visit.

Where informal observations are made of field trips, laboratory activities and other activity events, you should consider the use of motion picture, video tape and still pictures to document the activities.

Data Analysis. The authors of systematic observational scales usually describe special analysis methods. We will not attempt to review the large variety of analysis procedures in this document. These procedures can be found in resource materials such as **Mirrors of Behavior.**

The analysis of informal observational data is typically presented in verbal descriptive form. Most often, it is a summary statement of judgments made by the observer. Occasionally, this descriptive report is accompanied by photographs and/or counts of specific observations such as the number of students who demonstrated a specific behavior during the observation. These tabulations or counts can be converted to frequency distributions and/or percent distributions. They can be augmented by content analyses of descriptive reports.

CATEGORY 6 - ARTIFACTS

Environmental education programs can produce a variety of artifacts ranging from documents to art work produced by students. These products can include written compositions, reports of laboratory projects, copies of newspaper articles, newsletters, and class schedules. You can probably list two or three specific artifacts that are likely to be produced by your program.

Data Analysis. Artifacts such as compositions or copies of the minutes of staff meetings can be analyzed through content analysis. Categories should be established prior to reviewing these products.

Each product is examined carefully and the occurrence of each category of content recorded on a content analysis sheet. These may be tabulated by frequencies and/or percentage of occurrence.

Other forms of human judgment can be used with three dimensional artifacts. These judgments can be made on a rating scale similar to that used in the attitude inventory, or can be recorded in the form of verbal description. When rating scales are used, the analysis will be in the form of frequency tabulations or average ratings.

Measures of air quality and chemical analysis of water pollution are also a type of artifact data. Persons who use these types of technical data will usually be very familiar with the procedures for collecting and analyzing this information. Much of this analysis includes a trend analysis that shows increasing or decreasing amounts of pollution in the air or water over periods of time.

F. SUMMATIVE EVALUATION DESIGNS

The alternative designs for summative evaluation of environmental education can be described in terms of traditional research designs. Although some of the research designs will not be able to be used because of local restrictions, you should know the more basic designs.

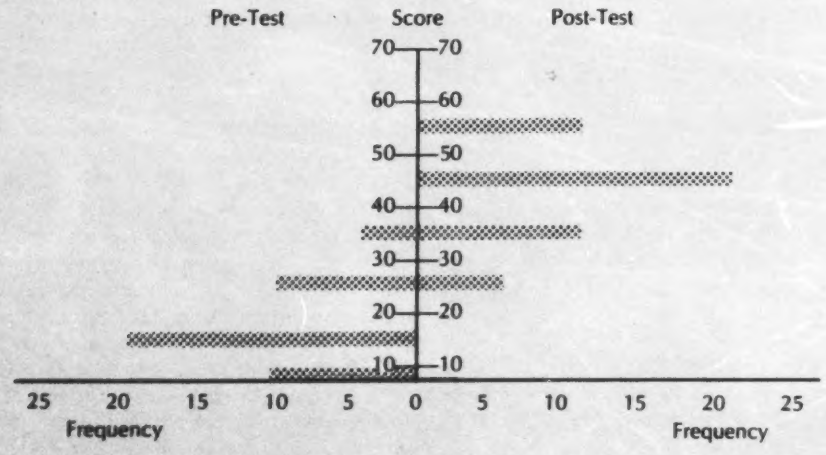
You want to use the design that allows you to relate positive gains in knowledge, skills and attitude to the environmental education program. The advantage of the stronger designs is that they can help rule out alternative explanations for measured gain. Weak designs limit your ability to demonstrate that positive gains are due to the environmental education program rather than to other causes.

THE ONE GROUP DESIGN

Post-test only — The **most often used** and **weakest** design is the one group post-test only summative evaluation strategy. For example, the environmental education program is provided and then data is collected. The data may be test scores or reaction questionnaires. When our main purpose is to demonstrate that the program has been positively received by an adult community, or by a group of teachers and students in a school, this design can be perfectly adequate. However, when we want to show a gain in knowledge, skill or attitude from either a community group or a group of teachers or students, this design is particularly weak. When you are forced to rely on this design and are interested in determining if there were gains in performance, you may consider asking the learners to indicate the extent to which they believe their present knowledge or skill can be attributed to their environmental education experiences.

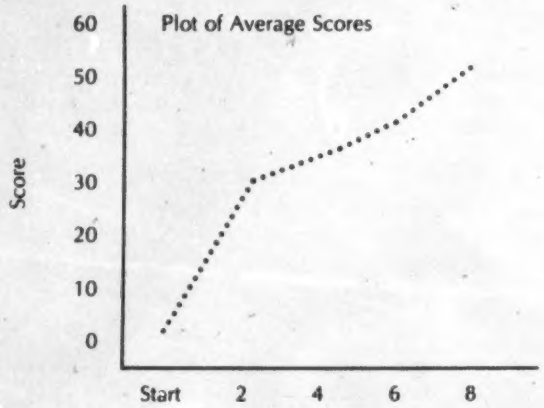
Pre-test/Post-test — The one group pre-test/post-test design is a substantial improvement over the one group post-test only design. This design may be used when it is possible to obtain comparable measures from the learners before and after the program. The results from the pre-test and post-test are compared. This can be a simple comparison of the average scores on the test or a comparison of the frequency distributions from the pre-test and post-test. One method for comparing frequency distributions is illustrated below.

PRE-TEST/POST-TEST
FREQUENCY COMPARISON



In comparing the pre-test and post-test averages, or in comparing the pre-test and post-test frequency charts, you should be prepared to justify why you considered the change to be of some importance. Why is the change enough to be considered valuable? The answer to this question must come from your own logic and reasoning. There is no statistical procedure that can provide the answer.

One Group Trend Analysis. The strongest design to use in the one group situation is a trend analysis. A trend analysis can be developed in a couple of different ways. If a program runs over one or more years and is used with the same group of individuals over the total time, it is possible to gather comparable measures at several points in time during the program. You can develop a trend of the group averages over time. A curve is obtained when these averages are plotted on a graph. An example of such a graph is given below.



It is also possible to use a trend analysis to cover a period of years with different individuals. For example, if the environmental education program is being used in the elementary school you may be able to use the scores of the sixth grade students that graduate from the elementary school each successive spring. If you have the luxury of plotting these average scores over a period of several years, you may be able to demonstrate a positive impact of the environmental education program. This plot would be very similar to the graph demonstrated above, but rather than using months in the program, you would use years.

Both examples of the use of trend analysis require the evaluator to explore alternative explanations for the demonstrated increase in scores. You are somewhat susceptible to claims that the increase in scores is, for example, due to discussions of environmental issues on local TV programs rather than to your program.

A variation of trend analysis can also be used with artifact and record data. It might be possible to demonstrate the impact of a community awareness program by monitoring articles in newspapers and letters to the editor. Again, you would have to build an argument for your belief that the increase in the articles or letters is due to the environmental education awareness efforts rather than to other causes.

THE TWO GROUP DESIGN

Random selection — The most ideal form of the two group design is to randomly select individuals or classroom groups to be included in the environmental education program. (Part B of this appendix, p. 41, contains a discussion on random selection.) If the program is provided to a randomly selected group of learners and the other learners are used as a control group, both groups should receive a pre-test and a post-test. The averages of the pre-measures of the two groups are compared. You would expect these two averages to be nearly equal. After the program the averages of the two groups can be compared and you would expect the group receiving the program to have more positive scores. These pre-test and post-test means can be compared by using the t-test. The t-test can be used to demonstrate the statistical significance of the differences. However, you still must discuss the importance of the differences between the two averages. It is quite possible to have differences between the two groups that are statistically significant, but are not large enough to have practical meaning. The determination of the amount of difference required for practical significance cannot be

determined with statistics. Importance can be determined only by the persons who are running the program.

When classroom groups are randomly selected, the data analysis must be done carefully. In this case the raw data for the analysis should be the classroom average rather than the individual student. If you have a small number of classes, say only two or three in the environmental education group, and two or three in the control group, and can demonstrate that there is relatively little difference between the classes within the groups, you can use the information from each individual in every class. However, if you notice that some classroom groups show substantially more improvement than others, you should use classroom averages as the unit of analysis. In this case try to determine the extent to which the teachers in each class use the program and then relate the extent of use of materials to the amount of change in each classroom.

Sometimes you are not able to obtain pre-test data from the two groups. If the groups were randomly selected from the same overall pool of students or classes, you can feel comfortable in comparing the post-test scores. A trend analysis can also be used with the two groups. The trend analysis is developed as described under the one group design. However, in this case, you would develop one trend line for the environmental education group and a different trend line for the control group.

No random selection — A slight modification of the analysis procedures is required when the two groups are formed without random selection. You should not try to use a t-test to examine the statistical significance of the differences between averages. An inferential statistical test such as the t-test has no meaning without random selection.

When we are using available learners but cannot randomly select the students or groups and are restricted to using only post-test data, it is important to establish a good logical argument about the probable equality of the two groups prior to the program. If this logical argument cannot be developed, the value of the post-test information is substantially weakened.

INCREMENTAL INCLUSION DESIGN

The incremental inclusion design is a modification of the two group design. Rather than excluding the control group from the environmental education program altogether, it is possible to only delay their involvement. For example, if the students or classes are randomly selected and placed into two groups, it may be possible to test all the students at the beginning of the year, involve half of the students in the environmental education program for the first semester, test all the students at the end of the semester, and then introduce the environmental education program to the second group of students during the second semester. Use a final testing of all the students at the end of the year. This procedure gives you three test scores from all students — beginning of the year, middle of the year, and end of the year. The average scores from the two groups can be compared three times. The average scores should be nearly equal at the beginning of the year. We would expect the environmental education group to have more positive scores on the mid-year test and the two sets of scores to be nearly equal on the end of the year test. Because of some forgetting, average scores for the group that received the environmental education program during the first half of the year may be slightly lower on the end of the year test. If the groups are randomly selected, it is possible to use a t-test to compare the means. A more sophisticated analysis would use a procedure called "analysis of variance." If you are not familiar with these data analysis procedures, you will want to consult a data analyst.

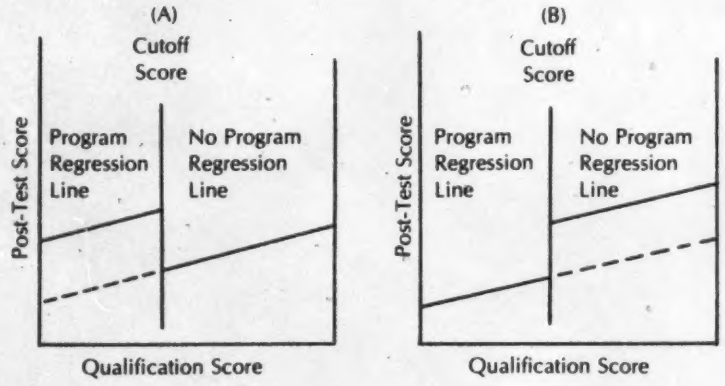
Group One	Pretest	1st half program	2nd test	2nd half no program	Final post-test
Group Two	Pretest	1st half no program	2nd test	2nd half program	Final post-test

REGRESSION DISCONTINUITY DESIGN

There may be a situation in which students have to qualify in order to be involved in the environmental education program. There is sometimes a test or other measuring device used to establish qualifications. Under these conditions you may be able to use the Regression Discontinuity Design. This design requires a continuous measure such as an achievement test be used to determine those who qualify for the program. You also must have an exact cutoff score that is used to determine

qualification scores. Those individuals on one side of the cutoff score are involved in the program and those on the other side are excluded. The second **requirement** is that the post-program measure must also be a test or some continuous measure. (A continuous measure is a measure on which each individual can earn different scores and these scores range over a gradually increasing set of values.) A typical achievement test represents a continuous measure. A person's weight would also be based on a set of continuous scores, if we assume that weights are scores. However, if you categorize people such as high, moderate or low achievers, the categorization is not a continuous score.

If you meet the conditions described above, the impact of the group that qualifies for the program can be demonstrated through the development of two regression lines. Regression analysis is used to develop these trend or regression lines. If you are not familiar with this technique, you should consult a data analysis specialist. The diagrams below illustrate two examples that demonstrate positive impact of the program.



In Diagram A (left) persons who scored below the cutoff point were permitted to enter the program. The difference between their regression line and the extended regression line (dotted line) of the other group represents the positive impact of the program. In Diagram B (right) the group that scored above the cutoff was permitted to enter the program. Again, the difference between the program regression line and the dotted line is a measure of the positive impact of the program.

NOTE: You have to get post-test scores for both groups.

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